MONTHLY WEATHER REVIEW.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for March, 1903, is based on data from about 3300 stations, classified as follows:

Weather Bureau stations, regular, telegraph and mail, 160; West Indian service, cable and mail, 8; River and Flood service, 52, river and rainfall, 177, rainfall only 62; voluntary observers, domestic and foreign, 2565; total Weather Bureau Service, 2962; Canadian Meteorological Service, by telegraph and mail, 20, by mail only, 13; Meteorological Service of the Azores, by cable, 2; Meteorological Office, London, by cable, 8; Mexican Telegraph Company, by cable, 3; Army Post Hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Meteorological Service, 75; Jamaica Weather Service, 130; Costa Rican Meteorological Service, 25; The New Panama Canal Company, 5; Central Meteorological Observatory of Mexico, 20 station summaries also printed daily bulletins and charts, based on simultaneous observations at about 40 stations; Mexican Federal Telegraph Service, printed daily charts, based on about 30 stations.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Territorial Meteorologist, Honolulu, H. I.; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander W. H. H. Southerland, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San José, Costa Rica; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. M. Shaw, Esq., Secretary, Meteorological Office, London; Rev. Josef Algué, S. J., Director, Philippine Weather Service; and H. H. Cousins, Chemist, in charge of the Jamaica Weather Office.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h\ 30^m$ west of Greenwich. The Costa Rican standard of time is that of San José, $0^h\ 36^m\ 13^s$ slower than seventy-fifth meridian time, corresponding to $5^h\ 36^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

Gales of unusual winter intensity, due to persistent low barometric pressure over the British Isles, prevailed over the eastern Atlantic and the western European coasts during a great part of the month. In the United States the month was notably free from severe gales.

During the second decade of the month abnormally high temperatures prevailed east of the Rocky Mountains, and the highest temperatures on record for the season were recorded at a number of points in the northeastern districts.

The monthly precipitation was unusually heavy in the interior of the Atlantic coast States, in the west Gulf coast districts, in California, and the interior of Washington.

High water in the rivers inundated much valuable land in the lower Mississippi Valley.

The only severe storm of the month on the Atlantic coast advanced from Florida to the Canadian Maritime Provinces from the 29th to the 31st. This storm increased in intensity as it advanced northeastward, and showed central barometric pressure below 29.40 inches on the southeast coast of New England on the morning of the 31st, and a reading of 29.22 inches at Sydney, C. B. I., at the evening report of the 31st.

No general storms of marked strength were reported on the coasts of the Gulf of Mexico. On the 18th and 19th, however, strong easterly, shifting to northerly, winds occurred on the Texas coast, attending the passage of a barometric disturbance southeastward over Texas.

High winds occurred on the lower Lakes on the 7th. On the 19th and 20th a disturbance moved east-northeastward over the Lake region, causing wind velocities of 48 miles an hour at Chicago, Ill., and Buffalo, N. Y. During the 23d a barometric disturbance developed over Lake Michigan and moved thence northeastward, attended by gales over the Great Lakes.

High winds prevailed on the extreme north Pacific coast from the 6th to the 10th, with maximum velocities of 90 miles at North Head and 68 miles an hour at Tatoosh Island, Wash., on the 10th. On the 27th the wind was high on the Washington coast, and gales were reported on the 30th on the northern California, Oregon, and Washington coasts.

Timely and ample warning was given of all gales that visited the sea coasts and Great Lakes of the United States.

The cold periods of the month were neither severe nor prolonged. On the 1st the temperature was below zero in southwestern Kansas and heavy frost occurred in central and northern Texas and northwestern Louisiana. On the 6th light frost was reported in the San Joaquin Valley, Cal., and by the morning of the 7th the frost line had extended to Los Angeles, Cal. From the 18th to the 21st a cold wave of moderate intensity advanced from the British Northwest Territory over the Western and Northwestern States, attended on the 21st by heavy frost in northern Texas and northwestern Arkansas. On the 18th heavy frost occurred in the Sacramento Valley

and light frost in the San Joaquin Valley. From the 24th to the 29th low temperatures prevailed in the Southern States, with light to heavy frosts in the interior of the Gulf and South Atlantic States.

Injury to fruit buds and blooms by frost was reported in northern Texas, Oklahoma, Tennessee, and the Ohio Valley.

In the North Pacific coast States frost was frequently reported during the last half of the month.

The frosts of the month were anticipated by the regular forecasts and special warnings of the Weather Bureau.

At the close of February the rivers of the Ohio Valley and the Gulf States had risen to flood stages, and the Mississippi River had passed the danger line from the mouth of the Ohio River to the Gulf of Mexico. At Cairo, Ill., the river rose to a maximum stage of 50.6 feet on the 15th, 16th, and 17th; at Memphis, Tenn., to a stage of 40.1 feet on the 20th; at Arkansas City, Ark., to a stage of 53 feet on the 27th and 28th; at Greenville, Miss., to a stage of 49.1 feet on the 27th; at Vicksburg, Miss., to a stage of 51.8 feet on the 27th and 28th, after which dates the river began to subside. At New Orleans, La., the river rose to a stage of 20.3 feet by the 31st. At all of the points named, excepting Cairo and Vicksburg, the river stages reached were the highest on record.

Special bulletins and advices regarding the present and anticipated stages of the Ohio and Mississippi rivers were issued and telegraphed throughout the affected districts preceding the floods and during their continuance. The timeliness and accuracy of the forecasts permitted the adoption of all possible means to protect life and to guard against loss of property.

Recognizing, early in the month, the seriousness of the situation, the official in charge of the Weather Bureau office at New Orleans, La., issued on the morning of the 9th, the following warning of the unprecedented high water:

The Mississippi River is now within one and four-tenths feet of the highest water ever recorded, and the Atchafalaya within one foot of the highest water on record. These rivers will continue to rise slowly during the next three or four weeks and all interests are advised to prepare for a stage of twenty-one feet at New Orleans and a corresponding rise in the Atchafalaya if levees hold volume of water now coming.

The following comments have been made by the New Orleans daily press with regard to this and subsequent warnings issued for the lower Mississippi Valley:

The Times-Democrat, March 16, 1903:

Barely a week has passed since the above warning was issued and the river has risen 1.2 feet and is already within 1.7 feet of the stage predicted. When the warning was first issued there were those who were inclined to doubt a record-breaking flood, but previous warnings of the Weather Bureau had been so accurate that the levee boards began strengthening the levees for a 21-foot stage. Present stages of the river indicate that preparations for the stage named in the warnings were not commenced too soon, and if the water is held within the levees from Vicksburg south, the timely warnings of the Weather Bureau must come in for their share of credit along with the efficiency of the recent improvements of the levees.

The Times-Democrat, March 16, in an editorial advised the levee board as follows:

It must now be clear, however, that the board should not relax its efforts to strengthen the levees in this district. The river, which is already high, will certainly rise even higher within the next fortnight. Indications are now plentiful that the waters which touch the gage at 19.3 feet will, before April 1, go as high as 21 feet. In its official report the Weather Bureau has warned the public to prepare for such a rise. This warning can not be disregarded with impunity.

The Daily Picayune, March 30, 1903:

The conditions now in the Mississippi and its tributaries stand as a testimonial to the timely and accurate warnings issued by the United States Weather Bureau three weeks ago to-day. Too much can not be said in commendation for such efficient and valuable warnings. These warnings have added much to the already great popularity of the weather service in this section.

The Times-Democrat, March 30, 1903:

The lower Mississippi River and tributaries are practically at stages forecasted by the United States Weather Bureau three weeks ago. Preparations which have been made by the public to meet these high waters show the great value of such timely and accurate warnings.

BOSTON FORECAST DISTRICT.

The weather was phenomenally mild, the monthly mean temperature over the district ranging from 4° to 13° above the normal. There was much cloudy weather, and the precipitation, which was chiefly in the form of rain, was considerably in excess of the monthly normal. A conspicuous feature of the weather was the absence of high winds and severe gales along the coast, which are of common occurrence in March in New England. Only four storm warnings were issued during the month and no storms occurred for which warnings were not issued.—*J. W. Smith, Forecast Official.*

NEW ORLEANS FORECAST DISTRICT.

Taken as a whole, March was mild, and but one general storm crossed this district during the month. Cold-wave warnings were ordered for Oklahoma and the northwestern portion of east Texas the evening of the 18th and storm southeast warnings were ordered for the Texas coast. On the 19th cold-wave warnings were extended to Arkansas and storm warnings changed to northwest on the Texas coast.

The feature of greatest interest in the eastern portion of this district during the month was the river warnings. On the 7th interests were advised to prepare for a stage of 20 feet, or higher, at New Orleans. Warnings for stages of 39 feet at Melville and 37 feet at Alexandria were issued on the 12th, and for 45 feet at Monroe were issued on the 14th.

Notwithstanding there are several crevasses above here, the river had for several days been oscillating between 20.1 and 20.4 feet. The highest stage in the other rivers was as follows: Melville, La., 38.5 feet, 31st, and rising; Alexandria, 36.2 feet, 27th; Monroe, La., 44.5 feet, 26th to 28th. The above were practically the stages forecast two to four weeks in advance. Warnings were repeated by mail from day to day with such changes as conditions called for. The situation along the Mississippi at the close of March was very critical. Much valuable land was under water and fully thirty days' continuation of high water was in sight. It was impossible at that time to form any estimate as to what the damage would amount to. Eventually it was found to be considerable, and it would have been much greater had the warning for a stage of 21 feet at New Orleans been deferred another week. The warning was distributed on the morning of the 9th; that afternoon the levee boards met and arranged to have work commenced the following day raising and strengthening the levees. A close watch was kept on the levees throughout the district, and they were strengthened as much as possible. At the close of the month the temporary levees along the commercial front of New Orleans were 2 to 5 feet high, and in many places the water was 12 to 18 inches above the height of the levees on the 9th, the date the warning for 21 feet was issued. No breaks had occurred so far in the levees along the Atchafalaya, notwithstanding the water stood 1.6 feet higher than ever recorded before. Several breaks occurred along the Bayou Lafourche. Only one break had occurred in the levees of the Mississippi proper between the mouth of the Red River and New Orleans, and that one is almost 40 miles above New Orleans, known as the Hymelia crevasse. Other breaks would have occurred, however, had it not been for the prompt action taken by the levee board as a result of the timely warnings issued by the Weather Bureau. An illustration of the value of every crevasse prevented may be taken from the Hymelia crevasse, 40 miles from New Orleans, on which over $100,000 had been spent in efforts to close the break, and ultimate success was still very doubtful, and if successfully closed at least as much more must be expended. Praises for the Weather Bureau, as a result of these warnings, were heard on all sides,

both from the press and the people. As soon as information can be gathered a full report on the flood will be made.—*I. M. Cline, Forecast Official.*

CHICAGO FORECAST DISTRICT.

Advisory messages were sent out as usual during the month to open ports on Lake Michigan in advance of approaching storms of considerable energy. The most severe storm of the month developed in the Southwest during the 21st, and moved slowly northeastward, reaching Lake Michigan on the 23d–24th. It was accompanied by snow and a westerly gale. Warnings were issued on the morning of the 23d, about twelve hours in advance of the storm; and, as no casualties of any kind were reported, it is probable that vessel masters profited by the advices given.

A cold wave developed in the British Northwest during the night of the 11–12th. Cold-wave warnings were ordered for North Dakota on the 11th, and for South Dakota, Nebraska, Minnesota, and northwestern Iowa on the 12th. The cold wave was practically confined to these limits, although a decided fall in temperature occurred over the greater portion of the district. Another cold wave appeared in the British Northwest on the morning of the 18th, and gradually overspread the entire district, reaching the eastern limits on the morning of the 21st. Ample warnings of its approach were issued; shippers, railroads, and other transportation companies being notified well in advance.—*H. J. Cox, Professor of Meteorology.*

DENVER FORECAST DISTRICT.

Severe weather prevailed in Wyoming and eastern Colorado from the 18th to the 23d, but with this exception the conditions, as regards temperature and precipitation, were such as are commonly noted during March.

The storm of the 18th, which was attended by snow and low temperatures in Wyoming and eastern Colorado, was forecast the preceding morning. This low area, which was persistent in the middle Plateau from the morning of the 12th until the night of the 17th, gave excessive cloudiness and an unusual amount of fog, but very little precipitation. Early in the morning of the 18th warnings of a cold wave, with high winds and snow, were sent to points in Wyoming and northeastern Colorado, and railroad interests were promptly advised. The snowfall was heavy, and being attended by a northerly gale, business and transportation were brought to a standstill, especially in north-central Colorado. The low temperatures that followed were rather severe to range stock interests.—*F. H. Brandenburg, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

The month opened with generally pleasant weather throughout California, quickly followed by a moderate storm over the northern portion of the State. Southwest storm warnings were displayed at Point Reyes at 8 p. m. on the 2d, but were not verified. Warnings of high southerly winds were sent to stations in Nevada and southern California; high winds prevailed on the 3d and the warnings must be considered as late. A moderate depression over the Sierra caused general rains in California and snow in Nevada; in the vicinity of Los Angeles unusually heavy rains fell. Heavy frost occurred on the morning of the 6th. Another disturbance prevailed on the coast on the 8th, and was also accompanied by generous rains throughout the entire State. Southeast storm warnings were displayed from Point Reyes to Eureka, and were verified, high southerly winds prevailing along the coast. On the 12th a rainfall of 2.32 inches was reported at Eureka. A marked disturbance prevailed over California and Nevada on the 13th; rain fell over the entire State and thunderstorms occurred in the interior. The weather continued unsettled and showers fell on nearly every day in some portion of the State. A hailstorm occurred at San Francisco on the 16th. From the 17th to the 21st the weather was fair. Another disturbance appeared over Nevada on the 23d and, as in previous cases, was accompanied by general rain. At Los Angeles a rainfall of 3.32 inches was reported for the twenty-four hours ending 5 a. m., 25th. The weather continued unsettled during the rest of the month. Southeast storm warnings were displayed from Point Lobos on the 27th, and were verified. The month as a whole was an unusually stormy one; the rainfall much exceeds that of an average March. No serious frosts occurred and the damage to fruits was slight.—*A. G. McAdie, Professor.*

PORTLAND, OREG., FORECAST DISTRICT.

The storms of March passed inland farther south than usual and only one severe storm visited the North Pacific States during the month. It made its appearance over western British Columbia on the morning of the 9th, and storm warnings were immediately ordered at all stations in the district. The gale reached its height about twenty-four hours later, when maximum velocities of 90 miles at North Head and 68 miles at Tatoosh Island were recorded. Other storms occurred on the 6th, 26th, and 30th, for which warnings were displayed in time to be of benefit. Frosts were reported quite frequently during the last half of the month and were accurately forecast.—*E. A. Beals, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	27, a. m*	51	114	4, a. m.	48	54	4,200	5.0	840	35.0
II	2, p. m.	50	110	7, p. m.	46	60	2,650	5.0	530	22.1
III	6, p. m.	38	122	10, a. m.	46	60	3,400	3.5	971	40.4
IV	8, p. m. / 9, a. m.	41 / 51	124 / 114	12, p. m.	39	75	2,925 / 2,500	4.0 / 3.5	731 / 714	30.5 / 29.8
V	11, p. m.	54	114	16, a. m.	46	60	2,800	4.5	622	25.9
VI	17, p. m.	54	114	23, p. m.	46	60	4,100	6.0	683	28.4
VII	21, a. m.	51	120	26, p. m.	35	76	3,100	5.5	564	23.5
VIII	26, a. m.	53	108	30, a. m.	46	60	2,800	4.0	700	29.2
Sums							28,475	41.0	6,355	264.8
Mean of 9 paths							3,164		706	29.4
Mean of 41.0 days									694	28.9
Low areas.										
I	4, p. m.	39	120	8, a. m.	39	85	2,700	3.5	771	32.1
II	17, a. m.	38	114	20, p. m.	45	80	2,375	3.5	678	28.2
III	22, a. m.	29	95	23, a. m.	38	80	1,100	1.0	1,100	45.8
IV	23, p. m.	45	88	25, a. m.	48	68	975	1.5	650	27.1
V	28, a. m.	48	123	31, p. m.	46	60	3,000	3.5	857	35.7
VI	28, p. m.	25	82	31, p. m.	46	60	2,000	3.0	667	27.8
Sums							12,150	16.0	4,723	196.7
Mean of 6 paths							2,025		787	32.8
Mean of 16.0 days									759	31.6

*February.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*Geo. E. Hunt, Chief Clerk, Forecast Division.*

RIVERS AND FLOODS.

The river conditions during March were exceptional and noteworthy, and the month will always be memorable for the general character and widespread extent of its floods. While the precipitation was not excessive, except in Louisiana and southeastern Texas, yet its periodic distribution was such that

floods, many of them dangerous and destructive, occurred over all watersheds east of the Rocky Mountains, except the Missouri, the upper Mississippi, and those of New England. The abnormally high temperatures (the average excess ranging from 3° to 12°) also contributed very materially to the flood production. The snows were quickly melted, adding their volume to the rainfall, and there was an absence, after the heavy rains, of the cold waves which are usually depended upon to check the rise of flood waters. It is also apparent that the proportion of run-off to rainfall was greater than usual, as the heavy and general rains of February had left the ground in such a thoroughly saturated condition that comparatively little of the succeeding March rains was absorbed.

The great flood in the lower Mississippi continued throughout the month, attaining higher stages than were ever before recorded. A full description of this flood, and those of the great tributary streams, the Ohio, Tennessee, Arkansas, and Red, will be published at a later time.

The Wisconsin River was in flood during the second half of the month, as a result of the high temperatures and copious rains from the 16th to the 20th, and warnings were issued for the first time to towns along the river. Flood warnings along the Wisconsin River are of peculiar importance owing to the fact that comparatively low stages can cause great damage. In the vicinity of Portage, Wis., for instance, the Wisconsin and Fox rivers are but a mile or two apart, and levees have been constructed to prevent the waters of the former river from flooding the Fox River Valley. These levees will retain but 12 feet of water, and the maximum stage reached at Portage during this flood was 11.1 feet. The value of the flood warnings is evident.

The flood of March 1 in the Pittsburg River district was caused by the heavy rains of February 28, and the following report thereon was made by Mr. A. McC. Ashley, official temporarily in charge of the United States Weather Bureau office at Pittsburg:

On the morning of February 28 the 8 a. m. reports from the Allegheny and Monongahela stations showed that a heavy rain, averaging about one inch, had fallen on both watersheds during the preceding twenty-four hours and that both the main streams and their numerous tributaries were rising rapidly. Special reports were called for from all up river stations, and it was announced on the weather map that from the reports already received a stage of over 20 feet was indicated inside of twenty-four hours.

With the turn of the barometer following the passage of the storm area that had caused the rain, this section was struck, about 11 a. m., by a violent northwest wind squall which prostrated telegraph lines in all directions and seriously interfered with the receipt of special reports. No reports at all came through from Warren, Clarion, or Brookville, Pa., until the next day, and all other special reports were delayed from one to six hours. The reports from Parker were of little value because an ice gorge, which broke shortly after 8 a. m., had raised the Allegheny at that place to an abnormally high stage at 8 a. m., and with the passing out of the ice, the Parker stage decreased steadily all day. When it is recalled that the Allegheny delivers twice as much water as the Monongahela, under similar conditions, the difficulties under which we labored will be appreciated.

At 5:15 p. m. the police departments of both cities were informed that the water would at least reach a 24-foot stage at Pittsburg early the following morning, but that as both rivers were still rising at headwaters, an even higher stage was probable, and that all interests likely to be affected should keep in touch with this office. This information was spread from house to house along the river fronts by the police and was also bulletined in the windows of the newspaper offices. Washington was notified by telegraph.

At 9:30 p. m. a final forecast was issued predicting a stage of from 26 to 28 feet by 8 a. m. of March 1, and all interests affected by 29 feet of water were advised to make preparations for that stage.

At 9:30 a. m., of March 1, telegrams were forwarded to all displaymen in the Wheeling section to the effect that a stage of from 40 to 42 feet was probable in the Ohio at that point by the following morning. The crest stage was 40.2 feet or 4.2 feet above the danger line.

On the morning of March 1 the Monongahela, from headwaters to Lock No. 4, had begun to fall, but the Allegheny was still rising slowly at all points. Before we received the regular 8 a. m. reports the Western Union offices along the Allegheny had been closed, it being Sunday, and it was impossible to secure specials during the day. We were then compelled to depend entirely upon the rate of rise at Herrs Island Dam in advising local interests during Sunday, but we assured all who called that the crest would not be above 29 feet on the Pittsburg gage.

The following record of observations, in feet, will indicate the accuracy of the warnings disseminated:

Pittsburg gage: February 28, 8 a. m., 7.9; 12 noon, 12.0; 2 p. m., 14.0; 4 p. m., 16.0; 6 p. m., 17.5; 8 p. m., 20.0; 10 p. m., 22.0; 12 midnight, 23.7. March 1, 2 a. m., 24.9; 4 a. m., 25.8; 6 a. m., 26.8; 8 a. m., 27.5; 10 a. m., 28.0; 12 noon, 28.4; 2 p. m., 28.8; 3 p. m., 28.9, crest; 4 p. m., 28.9, crest; 5 p. m., 28.9, crest; 6 p. m., 28.9, crest. March 2, 8 a. m., 25.5; March 3, 8 a. m., 17.5.

Wheeling gage: February 28, 8 a. m., 13.0; March 1, 8 a. m., 28.6; March 2, 8 a. m., 39.7; March 2, noon, 40.2, crest; March 3, 8 a. m., 37.3; March 4, 8 a. m., 27.5.

A conservative newspaper estimate places the local loss at about $100,000, more than half of this amount representing the wages of men temporarily thrown out of employment, and the balance the injury to buildings and fixed machinery by mud and water. The newspapers also state that owing to the timely warnings given out by the Weather Bureau all movable property in the low lying districts was removed to a place of safety in advance of the rise of the water.

The New England rivers, and particularly the Connecticut, were at fairly high stages during the latter portion of the month. The general rains over the watersheds from the 21st to the 25th were responsible for the rise in the Connecticut. A stage of 32.8 feet was reached at Wells River, Vt., on the 24th, and one of 23.3 feet at Hartford, Conn., two days later, not sufficiently high, however, to cause any damage.

There were three freshets in the Hudson and Mohawk rivers; one on the 1st and 2d, when the ice went out; one from the 10th to the 14th, and one from the 23d to the 26th. The two latter were caused by the heavy rains that occurred within the days mentioned. During these freshets the increased facilities for the reception and dissemination of flood reports from the center at Albany were put to a practical test for the first time. Frequent reports were received from the substations and warnings issued whenever necessary. They were accurate and timely and were well received by all interested. Many commendatory notices were received regarding the new service and its benefits.

Conditions along the Susquehanna River became threatening on the 9th and again on the 23d, necessitating the issue of warnings for moderate flood stages. The maximum stage reached was 24.4 feet at Wilkesbarre, Pa., 5.4 feet above the danger line. No damage of consequence was reported.

Nothing of interest occurred along the Potomac, although there were sharp rises on the 1st, and from the 23d to the 25th, caused by the same stormy conditions that produced the floods both to the northward and southward.

There were two freshets in the James River; one on the 2d that caused a 12-foot stage at Richmond, Va., without damage, as due notice had been given, and another on the 24th and 25th, of which the following report was made by Mr. R. F. Young, official temporarily in charge United States Weather Bureau office, Richmond, Va.:

Reports of heavy rainfall were received from Buena Vista on the 22d and river and rainfall messages from Lynchburg and Columbia on the morning of the 23d. Based on the information contained in these reports, advisory warnings were issued at 10 a. m. for a 12-foot stage locally and for Norwood and Scottsville, to be reached during the next twenty-four hours.

In the afternoon messages were received from Buchanan, Buena Vista, Charlottesville, and Columbia, which indicated a higher stage than that named in the first warning, and at 9 p. m. a second warning was issued for a stage of 15 feet to occur on the afternoon of the 24th. On the morning of the 24th the information was given out to the steamship companies and others interested that the water would remain high during the 25th; again on the morning of the 25th a bulletin was issued stating that there would be a second rise during the late afternoon or night to about the same stage as on the 24th, and that the water would fall slowly during the 26th. All the above information was promptly and effectually distributed and was the means of preventing loss and much inconvenience to the steamship companies and other business interests along the river. All property subject to damage was removed during the 23d and no loss was sustained except the expense of such removal.

Several vessels of the Old Dominion Steamship Company and the Clyde Line were detained at Norfolk for several days on account of the flood;

the agents were kept informed twenty-four to thirty-six hours in advance as to the time the water would leave their wharfs sufficiently to permit of unloading vessels. The wharfs remained submerged until late in the afternoon of the 26th.

The gage readings during the four days covered by the freshet were as follows: 23d, 8 a. m., 7.5 feet; 12:30 p. m., 9.2 feet; 6 p. m., 10.8 feet; midnight, 12.0 feet (unofficial); 24th, 8 a. m., 12.7 feet; noon, 13.0 feet; 6:30 p. m., 13.2 feet; 10 p. m., 13.9 feet (unofficial); 25th, 8 a. m., 13.0 feet; 1:45 p. m., 13.1 feet; 6:30 p. m., 13.2 feet; 11 p. m., 14.0 feet (unofficial); 26th, 8 a. m., 12.5 feet; 1:45 p. m., 10.5 feet.

The floods in the Roanoke and Cape Fear rivers passed off without unusual incident, although they rose above the danger lines at all points. At Weldon, N. C., on the Roanoke River, the maximum stage was 42.7 feet on the 26th, 12.7 feet above the danger line, and at Fayetteville, N. C., on the Cape Fear River, it was 50.5 feet, 12.5 above the danger line. Warnings were issued on the 22d for danger-line stages, and on the 23d for dangerous rises that would flood lowlands, etc. Warnings were also issued on the 30th for a moderate flood in the rivers of eastern North Carolina as a result of the heavy rains of the 29th.

The behavior of the rivers of South Carolina was described as follows by Mr. L. N. Jesunofsky, Official in Charge of the United States Weather Bureau office at Charleston, S. C.:

The streams in South Carolina were at abnormally high stages during March, 1903. The flood waters in the upper streams during February 22, 23, 24, and 25 did not reach Smiths Mills, on the lower Pedee, and St. Stephens, on the Santee, until the 6th and 7th of March, respectively, as correctly forecast.

The flood periods on the Wateree, the upper Pedee, and the Congaree were as follows: 1st to 2d, 22d to 25th, and the 30th and 31st. On the lower Pedee and the Santee they were as follows: 6th to 9th, and 28th to 31st. The freshets from the upper Pedee at Cheraw, S. C., were not expected at Smiths Mills until April 10; the flood waters from the Wateree, at Camden, and the Congaree, at Columbia, on the 30th and 31st were not due to reach the Santee, at St. Stephens, until April 10 or 11.

There was a rise of 15.0 feet in the Wateree River at Camden during the 1st and 2d, to a gage reading of 27.0 feet, or 3.0 feet above the danger line, on the 2d. The stream again rose rapidly from 8.5 feet on the 21st to 30.4 feet, or 6.4 feet above the point of danger, on the morning of the 25th, and began to recede during the early morning of the 26th. Heavy precipitation in the upper catchment basin of the Wateree, during the night of the 29th, caused a rise at Camden of 13.6 feet during the 30th and 31st, to a gage reading of 27.6 feet, or 3.6 feet above the danger point, by 8 a. m. of the 31st.

The Pedee, at Cheraw, rose 18.9 feet on the 1st and 2d, with but little drift in the stream. The greatest and most pronounced rise occurred during the 22d, 23d, and 24th. On the morning of the 21st the gage registered 5.8 feet; by 8 a. m. of the 24th the water reached a reading on the gage of 33.8 feet, or 6.8 feet above the danger line, a rise of 28.0 feet in seventy-two hours. Drift was running heavily during the 23d and 24th. The stream remained practically stationary during the 25th and 26th; receded 6.7 feet late during the night of the 26th to the danger line of 27.0 feet by the 8 a. m. observation of the 27th. There was a further rapid decline in the Pedee at Cheraw during the 28th, 29th, and up to noon of the 30th, when the stream began to rise rapidly, reaching at 8 a. m. of the 31st a gage reading of 26.2 feet, or within 0.8 foot of the danger point.

A rise of 10.2 feet was recorded at Columbia during the night of February 28 and the morning of March 1 at a stage of 14.0 feet, or within 1.0 foot of the danger line. The stream rose 21.5 feet, from a gage reading of 2.4 feet on the 21st to 23.9 feet, or 7.9 feet above the danger point, at 6 p. m. of the 24th. There was a rapid decline during the 26th, 27th, and 28th; on the afternoon of the 29th the stream began to rise slowly; during the night of the 29th and morning of the 30th it rose 12.5 feet to 16.0 feet, or 1.0 foot above the point of danger. There was an additional rise of 3.4 feet to a gage reading of 19.4 feet, or 4.4 feet above the danger point, at 8 a. m. of the 31st.

The flood waters at Cheraw, on the upper Pedee, during the 22d, 23d, 24th, and 25th, reached Smiths Mills, on the lower Pedee, by the 31st, and produced a rise of 5.2 feet, during the 28th, 29th, 30th, and 31st, to a gage reading of 17.9 feet, or 1.9 feet above the danger point, by the morning of the 31st.

The freshets at Camden, on the Wateree, and at Columbia, on the Congaree, on the 22d, 23d, 24th, and 25th, passed St. Stephens, on the Santee, seaward, on the 29th, 30th, and 31st, raising that stream 6.6 feet, to a reading of 15.6 feet, or 3.6 feet above the danger line, by 8 a. m. of the 31st.

No damage by the floods occurred so far as heard from, except the drowning of a few head of stock. The month throughout was highly favorable to the lumber interests. The freshets were forecast with a fair degree of accuracy. Navigation was uninterrupted and steamers carried more than the usual amount of freight.

The floods in the Georgia rivers were not of serious character, although stages above the danger lines were noted at many places from the 23d to the 25th. Warnings were issued at the proper time from the centers at Atlanta, Augusta, and Macon, Ga., and reports have been received showing that property in the latter district to the amount of perhaps $50,000 was saved by the warnings, although the maximum stage of water recorded at Macon was but 19 feet, 1 foot above the danger line.

The floods in the rivers of Alabama were caused by the heavy rains of February 27 and 28, in the Southern States, and the maximum stages were reached during the first five days of March. Warnings were issued on February 28, and, as usual, were well verified by the subsequent events. The floods, however, were not of grave character.

The following report on the floods in the rivers of Texas was made by Mr. E. H. Bowie, Official in Charge of the United States Weather Bureau office at Galveston, Tex.:

Within the time covered by the records of the Bureau for the State of Texas the winter rains have never before been so frequent and excessive as during the current season. All out door work was practically abandoned during the months of December, January, and February on account thereof, and in many sections railway traffic was seriously interfered with on account of spreading road beds and other conditions dangerous to life and property. These frequent and excessive rains culminated in a veritable downpour over practically the entire State on the 25th and 26th and immediate rapid rises of the water in the already overburdened river channels. The rainfall, in inches, for these dates for several of the observation stations in the State is shown by the following table. (See report of the Texas section of the Climate and Crop Service for February, 1903.)

The morning reports of March 26 showed excessive rains, and special river observations showed the following stages: Kopperl, 10 feet; Waco, 20.2 feet, and Booth, 21 feet. On this information and the known excessive rainfalls the following warning was issued:

"Excessive rains have fallen over the entire drainage area of Brazos River within the past thirty-six hours. Rapid rise in Brazos and tributaries to and above danger line at all points from Waco north within the next thirty-six hours. Heavy rise will continue at Waco and points south during several days. Flood stages probable at practically all points on Brazos River and tributaries. Heavy rises in Colorado and Trinity rivers also indicated. Please disseminate information for benefit of public."

This information was immediately disseminated by telegraph and mail and through the cooperation of the Southwestern Telephone and Telegraph Company to all sections that were thought liable to overflow.

The river at Kopperl rose to a maximum height of 12 feet on the day that the warning was issued; the rise at Waco was very rapid, from a stage of 13.2 feet the morning of the 26th to 27 feet during the early morning of the 27th, which stage was 3 feet above the danger line. South of Waco, in consequence of the large amount of water emptied into the Brazos by its principal tributaries, the rise was very rapid and prolonged for several days and the area flooded was somewhat greater than that of July, 1902. The flood crest moved slowly southward and passed Booth March 7, with a stage of 38.7 feet at that point.

Railroads traversing the Brazos Valley were forced to suspend traffic for several days owing to high water, and all roads were more or less affected thereby. A number of bridges were destroyed by the floods on the smaller rivers, and in some instances minor losses of stock occurred. The loss of stock and movable property was unquestionably minimized by the timely receipt of the warnings.

The floods were more or less general in other Texas rivers, the rises in the San Antonio, Guadalupe, Colorado, Trinity, Neches, and Sabine causing extensive inundation of lowlands and some loss of stock and movable property.

The rivers of the Pacific coast rose steadily during the month, but no high stages were reached except in the lower Sacramento River where the danger line was touched on the last day of the month. As the annual rise of the Columbia River is of special interest at this time, it is thought that a brief discussion of this subject will prove of value. The following article was prepared by Mr. E. A. Beals, Forecast Official in Charge of the United States Weather Bureau office at Portland, Oreg., and was first printed in the report of the Oregon section of the climate and crop service for March, 1903:

Reports from the headwaters of the Columbia and Snake rivers are to the effect that there was more snow in the mountains at the end of March than usual. The snow came early and was heavy during December and January, but light in February and March. It packed solid early in the season which insures slow melting, and abundant water for irrigation purposes is anticipated during the coming spring and summer in eastern Oregon, eastern Washington, and Idaho.

The annual rise in the lower Columbia River depends largely upon the temperatures during April and May. There is always snow enough in the mountains to cause a flood, provided it melts quickly, but estimates as to the probable spring rise must necessarily be empirical in character. In 1900 the high water at Portland, Oreg., was 17.8 feet on May 20. The snowfall that year was quite light over the entire drainage area. In 1901 the highest stage at Portland, during the spring rise, was 20.8 feet on June 3, and the snowfall was about the same as the year before, the higher water of 1901 being due to a backward spring. In 1902 the highest water at Portland was 20.8 feet on June 4, which is the same as the previous year, and it occurred on nearly the same date. The snowfall during the winter of 1901–02 was considerably heavier than during the preceding winter, and the spring was also backward. The reason that the water did not reach a higher stage is due to the fact that the melting of the snow was interrupted by several cool spells which checked the rise at high stages, and although the volume of water which passed out to sea was greater than in the previous year, the flood crest was no higher.

Many of those reporting the depth of snow in the mountains this year have stated the amount to be about the same as during the winter of 1898–99. The high water following at Portland that season was 24.2 feet on June 23. It is thought that with normal conditions during April and May the flood crest at Portland this year will reach a stage of 24 feet about the middle of June. Should the melting be rapid and continue uninterruptedly the stage will be somewhat higher than 24 feet, but with marked cool spells intervening the stage will be a foot or two lower than the foregoing estimate. A stage of 24 feet at Portland necessitates a stage of about 43 feet at The Dalles, and 25 feet at Umatilla.

The ice was entirely out of the rivers by the 27th of the month, that in the Red River of the North being the last to go. In the upper Mississippi River the time of breaking up was a few days later than in 1902. No ice was reported below Keokuk, Iowa. Navigation for short trip boats was opened at Keokuk on the 16th, and at La Crosse, Wis., on the 21st.

The Penobscot River opened on the 12th, but running ice was reported as late as the 25th. The upper Merrimac and upper Connecticut opened about the 8th, and the ice passed down without causing any damage. The last ice in the Connecticut River reported was at Hartford, Conn., on the 10th.

The highest and lowest water, mean stage, and monthly range at 171 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*

CLIMATE AND CROP SERVICE.

By Mr. JAMES BERRY, Chief of Climate and Crop Service Divison.

The following summaries relating to the general weather and crop conditions during March are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau; they are based upon voluntary reports from meteorological observers and crop correspondents, of whom there are about 3000 and 14,000, respectively:

Alabama.—The first part of March was continuously wet, the latter part, until the rain of the 29th, being more favorable. Farm work was very much delayed, though considerable corn was planted in uplands, some corn being up before the 31st. Very little cotton was planted. Wheat and oats made very good progress. In northern districts peaches that escaped the February freeze were killed by frosts of 25–26th, but in southern sections fruit was only slightly injured.—*F. P. Chaffee.*

Arkansas.—Rains and high waters during the first half of the month delayed farm work; weather and condition of soil, except in overflowed districts, more favorable during last half, and rapid progress had been made in the uplands, but the lowlands were not in condition to work. Very little preparation made for cotton planting. Upland wheat better than usual; that in lowlands suffered considerable damage. Very few oats sown. Some Irish potatoes planted. Peach crop will be short, though not a total failure. There promised to be an abundance of apples and small fruits.—*Edward B. Richards.*

Arizona.—The temperature was considerably below normal in the northern division and slightly below normal in the southern and western divisions. Good rains fell during the month over most of the territory, but the heaviest rains occurred generally toward the close of the month, and irrigation canals were running full of water. The cool weather retarded the growth of vegetation somewhat, but the favorable conditions of moisture largely overcame the effect of cold weather, and crops generally were in a promising condition at the end of the month. Feed on the ranges was generally good, and cattle were in fair to good condition.—*M. E. Blystone.*

California.—The warm weather and well-distributed rainfall during the month were very beneficial to all growing crops, and there was little injury to young fruit by frost. Deciduous fruit trees were in full bloom at the close of the month and gave promise of a heavy yield. Wheat, barley, oats, and grass made rapid growth and were in excellent condition. The grain acreage is larger than usual.—*G. H. Willson.*

Colorado.—Season backward; soil in good condition and plowing general the last week of the month. Seeding wheat, oats, spring rye, barley, and alfalfa well advanced in southern counties. Fruit trees somewhat damaged by February freeze and some pruning necessary. Garden planting begun. Range poor but starting nicely. Outlook unusually favorable for good and prolonged flow of water in Rio Grande; from other watersheds early flow promised to be much better than last year's, but late flow less than usual, if not augmented by rainfall.—*F. H. Brandenburg.*

Florida.—Warm weather with frequent rains characterized the month. The excessive rains were more or less disastrous to the vegetable crop over the southern part of the State, where the yield of tomatoes will be less than one-half of former years. The wet weather damaged or delayed all crops on lowlands. Much corn was replanted. On uplands the conditions were more favorable. Corn made fair progress and melons were doing well. Citrus trees and pineapples were very satisfactory.—*A. J. Mitchell.*

Georgia.—Prominent features of the month were high temperature, cloudiness, and frequent rains. There was a general absence of freezing temperature, the month, with one exception, was the warmest March since 1891. The precipitation in the northern sections was heavy, but in a few southwestern counties it was below the average. Excessive moisture proved detrimental to farm work, plowing for corn and cotton and the planting of these crops being much hindered. The peach crop was seriously damaged by the cold wave in February.—*J. B. Marbury.*

Idaho.—Weather conditions favorable for farm work prevailed during March, and the month was nearly normal as to temperature and precipitation. The winter weather was unfavorable for growth of grass on the stock ranges, but winter wheat was protected by snow and was in fine condition. There were heavy losses of sheep where not fed to hay and grain. The entire surplus hay crop has become exhausted. Fruit trees were in exceptionally healthy and vigorous condition.—*S. M. Blanford.*

Illinois.—In the northern district the weather was unseasonably warm, and the growth of grasses and meadows was greatly stimulated. Farm work was retarded on account of the soggy condition of the soil. The wheat crop in the central district was promising; in the southern district its condition was good, but somewhat uneven. Peach buds were seriously injured over the entire State, and probably killed in the central and northern districts.—*Wm. G. Burns.*

Indiana.—Wheat, rye, and clover were in excellent condition, except that a small acreage of wheat sown prior to September 25 showed effect of flies, and a small acreage was damaged by recent floods, and except, also, that clover was slightly injured in a few localities by alternate freezing and thawing. Plowing, sowing oats and clover, planting potatoes, and making gardens began.—*W. T. Blythe.*

Iowa.—The month was warm, with excess of cloudiness and fog, causing the frost to thaw rapidly. The saturated condition of the soil and lack of drying weather rendered field work impracticable except in very dry and sandy soil. Grass started early, and all fall sown crops came through the winter in excellent condition. Farm stock were generally thrifty.—*John R. Sage.*

Kansas.—A warm March, many fogs, and less wind than usual. Ground wet, retarding farm work. Wheat in good condition, an even stand, and growing well. Some oats sown. Rye doing well. Early peaches, apricots, and plums beginning to bloom in the south.—*T. B. Jennings.*

Kentucky.—Wheat was in excellent condition and very forward, and the outlook was decidedly promising. Winter oats and rye doing well. The sowing of spring oats progressing. Tobacco beds sown late on account of wet weather. Very poor prospect for peaches, many killed by freezes in February and latter part of March; hardy varieties will probably bear. Other fruits doing well. Grass in fine condition and stock doing well. Farm work much delayed by rain.—*H. B. Hersey.*

Louisiana.—Farming operations were materially interfered with by wet weather during the first and second decades of the month. More

favorable weather prevailed toward the close of the month and preparations for planting, which were much behind, were pushed vigorously. Several plantations suffered serious injury as a result of overflow. Cotton planting commenced toward the close of the month, but progressed very slowly. Corn planting was materially retarded. Wet weather interfered with cane planting and damaged seed cane. Fall plant and stubble cane were generally in good condition. Rice seeding was much behind. Truck gardens backward.—*I. M. Cline.*

Maryland and Delaware.—A warm and rainy month. Heavy rains delayed plowing, although fair advance was made on the uplands. The prevailing warmth produced luxuriant growth in wheat, rye, and grasses, but some damage was done to lowland wheat by water. Some oats were sown in all districts. Old meadows and fall sown grasses were thin, but spring sown clover did well. Lettuce, onions, radishes, and early potatoes were planted in many localities. A large acreage of canning peas had been sown and some were up. Peaches, plums, and strawberries were blooming in the southern counties. Tobacco beds were made and the early plants were showing.—*Oliver L. Fassig.*

Michigan.—Abnormally warm, with moderate precipitation during March, was very favorable to winter wheat and rye, which at the close of the month was in generally good and promising condition, but fruit buds had been forced and some peach damage was reported. Plowing was becoming general in many counties of the lower peninsula and some oats and clover had been sown.—*C. F. Schneider.*

Minnesota.—The precipitation was light and scattered, except from about the 15th to the 23d, during which period most of the month's precipitation occurred. There were both rain and snow during the month. The soil was frozen early in the month, but the frost came out of the ground in southern portions late in the month, leaving the soil wet. No preparation of the soil, or seeding, was possible except on a few knolls on the 30th or 31st.—*T. S. Outram.*

Mississippi.—The first three weeks were warm, cloudy, and rainy, and as a result farm work was much retarded. The last decade was fair and cool, and very favorable for farming operations, which were becoming general, except in the flooded districts. Oats were doing finely. Corn planting was begun on uplands. Vegetable crops were quite as forward as usual, although slightly damaged by frost on the 25th and 26th. Fruit prospects were poor north, but fair south.—*W. S. Belden.*

Missouri.—Although March was warmer than usual, in most sections of the State the soil continued so wet that but little progress could be made with farm work, and except in a few of the southern counties oat sowing had only fairly begun at the close of the month. The weather was exceptionally favorable for the wheat crop, which was generally reported as in a very promising condition and making a vigorous growth.—*A. E. Hackett.*

Montana.—In the greater part of Yellowstone and Rosebud counties and in the valleys on the west side of the Main Divide the weather was rather warm, but periods of cold weather were of frequent occurrence in other parts of the State, especially in Choteau, Valley, and Dawson counties. The precipitation was light in Valley and Dawson counties, along the southern border of the State as far west as Park County, and in Granite and southern Powell counties; in other portions of the State it was fairly copious. On March 31 the frost was out of the ground in but few localities and very little progress had been made with farm work. All stock improving.—*Montrose W. Hayes.*

Nebraska.—The first three weeks were warm, but the last ten days were unseasonably cold; the soil was wet from the heavy snows of February and generally was not in good condition to work until the last of the month; therefore very little work was done in March. Winter wheat and rye started nicely and generally were in unusually good condition at the end of the month.—*G. A. Loveland.*

Nevada.—The temperature was about normal and the precipitation above the average and fairly well distributed. Heavy snow fell in western portion on 31st. Plowing and seeding in progress toward close of month. Rains in the latter part of the month started grass to growing nicely. Season somewhat backward.—*J. H. Smith.*

New England.—March was unusually mild and very favorable for outdoor work. Grass, grain, and fruit, except peaches, wintered well; peaches were injured by the extreme cold weather in December. Plowing was begun in all sections and in some places garden seeds have been planted. The maple sugar yield was exceedingly light and of very poor quality. At the close of the month the season was from two to four weeks in advance of the average.—*J. W. Smith.*

New Jersey.—March, 1903, was exceptionally mild, the average temperature being the highest on record for that month, and was noted for the absence of high winds, snow, and frosts. In the southern part of the State plowing, planting, seeding of oats, and planting of early truck were well advanced, but in the central and northern portions the ground was too wet for plowing. Winter grain, clover, and grass made rapid growth, and at the end of the month were in fine condition, except on low fields, where considerable winter killing occurred. All early orchards and small fruits were so far advanced at the close of the month as to be exposed to injury from frost.—*Edward W. McGann.*

New Mexico.—Altogether March was a favorable month, except in parts of Lincoln County, where there was much suffering from drought. By the close of the month plowing was well begun, and some wheat sown in warmer sections.—*R. M. Hardinge.*

New York.—Snow disappeared and frost was out of the ground early in March; season about three weeks ahead of normal; weather very favorable for wheat, rye, meadows, and pastures. Fruit trees wintered well, but buds advanced to dangerous degree by reason of unseasonably warm weather; plowing begun but delayed by rains; very small crop of maple sugar.—*R. G. Allen.*

North Carolina.—The temperature was above normal the entire month, and the mean for the month was the highest on record. Killing frosts occurred on the 2d, after which no further frost occurred until the 26th and 27th, the latter without injury to vegetation. Before the end of the month fruit trees were generally in bloom and many forest trees in leaf. The excessive rainfall prevented much farm work and very little plowing was accomplished. Wheat, oats, and rye grew well. Truck crops and strawberries were unusually well advanced by the close of the month.—*C. F. von Herrmann.*

North Dakota.—Mild weather with less than the usual amount of snowfall prevailed during the month. No farming operations were carried on, the ground being frozen during the entire month.—*B. H. Bronson.*

Ohio.—The mean temperature was nearly 2° higher than ever before recorded. Winter grain, grass fields, and pastures started very rapidly with the warm weather. Fruit buds came out rapidly and early fruits were in bloom in many southern sections by the end of the month. Plowing was under way, some oats sown, and some potatoes planted in southern counties. There was very little snowfall. The weather was very unfavorable for maple sugar making.—*J. Warren Smith.*

Ohlahoma and Indian Territories.—Wet, cold soil prevented the progress of farm work, especially over Indian Territory, where but few oats and potatoes were planted. In Oklahoma, the conditions were more favorable and farm work was more advanced, oats and potatoes being mostly planted and the early sown oats coming up to a fair stand; wheat was generally in a fair condition and making good growth; grass was starting and stock was doing fairly well; rye, alfalfa, and volunteer oats were in good condition; fruit trees were damaged by the cold periods, but generally, the conditions were promising; peach, apricot, and plum trees were blooming.—*Chas. A. Hyle.*

Oregon.—Fall sown wheat came through the winter better than was expected earlier in the season, and but little reseeding will have to be done. The fall sown acreage, however, is much smaller than the previous year, and more than the usual amount of spring wheat will have to be sown to make up the deficiency. Fruit trees wintered well and some early varieties were in bloom at the close of the month. Stock continued poor on account of the shortage of pasturage.—*Edward A. Beals.*

Pennsylvania.—The mean temperature exceeded the normal by 10.4° and was the highest of record for the month of March. The precipitation was about 0.75 inch above the average, the snowfall being exceedingly light. At the end of the month the season was from two to four weeks forward, plowing and seeding were in progress, and fruits so far advanced as to be exposed to injury by frosts.—*H. A. McNally.*

Porto Rico.—Weather generally was quite dry and in the southern parts of the island the drought was very severe. All farming operations, excepting sugar making, at a standstill, awaiting rain. Sugar making was carried on continuously throughout the month with fairly satisfactory results. Young canes generally needing rain, especially the young ratoons. Tobacco cutting has been quite active and the yield very good; crop about harvested. Flowering of coffee trees backward and irregular. Other fruit trees blossoming. Small crops and pasturage becoming scarce.—*E. C. Thompson.*

South Carolina.—High temperatures, excessive precipitation, and general absence of killing frost made the month a noteworthy one. Vegetation grew rapidly. Farm work made slow progress. Planting operations were confined to the uplands of the eastern half of the State, where much corn, some cotton, rice, cane, tobacco, gardens, and minor crops were planted. Fruit prospects generally good. Wheat promising, but oats were destroyed to a large extent by a grain aphis over the eastern and central counties.—*J. W. Bauer.*

South Dakota.—The weather averaged somewhat warmer than usual and the precipitation was sufficient to insure ample moisture for early field work, but no seeding and but little preparatory work was done, due to the fields being too wet in the southern portion of the State and insufficient warmth elsewhere to free the soil of frost. Winter rye came through the winter in very favorable condition. Snow and cold rain in the second decade caused some slight loss of weak live stock on the ranges.—*S. W. Glenn.*

Tennessee.—Temperature and rainfall above normal; heavy rains in many sections and cloudy weather delayed plowing, and but little planting was done until latter days of the month; Irish potatoes were being planted and some gardening done; very little corn planted; tobacco beds all sown; wheat and other winter grains in fine condition generally and further advanced than usual, prospects better than for years at this period; late frosts did little or no damage, except to early fruits; planting spring oats delayed; clover and grass looking well.—*H. C. Bate.*

Texas.—Over the southwestern portion of the State the temperature was considerably below normal for the month, but elsewhere was very nearly the average. There was less than the usual amount of precipita-

In the following table are given, for the various sections of the Climate and Crop Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings:

Summary of temperature and precipitation by sections, March, 1903.

Section.	Temperature—in degrees Fahrenheit.								Precipitation—in inches and hundredths.					
	Section average.	Departure from the normal.	Monthly extremes.						Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest.	Date.			Station.	Amount.	Station.	Amount.
Alabama	59.4	+ 4.2	Bermuda	85	20	Riverton	26	25	5.91	+0.11	Maple Grove	8.83	Greenville	3.62
Arizona	54.2	— 0.8	Agua Caliente, Cochise.	95	29	Fort Defiance	3	1	1.16	+0.54	Flagstaff	3.77	Aztec, Yuma	T.
Arkansas	54.8	+ 3.2	Ozark	85	7	Pond	11	1	5.56	+0.22	Mossville	8.37	Pond	3.29
California	59.9	— 1.6	Imperial	104	9	Bodie	—21	7	5.80	+2.70	Pilot Creek	19.39	Volcano	0.00
Colorado	33.7	— 0.4	Lamar	80	31	Wagon Wheel Gap	—35	1	1.09	—0.40	Telluride	8.61	Vilas	T.
Florida	69.1	+ 3.7	Tarpon Springs, Orange City	91	3, 21	Holt, Molino	35	25, 26	5.52	+2.44	Jupiter	9.27	Jacksonville	2.55
Georgia	60.4	+ 5.2	Jesup	88	20	Clayton	25	2	6.74	+1.43	Clayton	14.81	Morgan	3.34
Idaho	34.9	+ 0.2	Garnet	79	30	Chesterfield	—27	1	1.68	+0.07	Grangeville	4.29	Chesterfield	0.48
Illinois	45.3	+ 6.4	7 stations	80	17–19	Kishwaukee	9	1	2.96	—0.16	New Burnside	6.29	Hoopeston	0.64
Indiana	46.7	+ 7.1	Avoca	81	18	Delphi	12	1	2.95	—1.03	Scottsburg	6.71	Veedersburg	0.87
Iowa	38.8	+ 6.6	Mount Pleasant	82	17	Baxter, Clear Lake	6	1	1.38	—0.53	Le Mars	3.90	Denison, Ruthven	0.15
Kansas	43.5	+ 2.1	Meade	87	31	Viroqua	—15	1	1.54	+0.01	Columbus	5.87	Ness City	0.10
Kentucky	52.5	+ 5.9	Pikeville, Richmond	85	18, 19	Loretto	19	2	4.43	—0.74	Alpha	6.83	Fords Ferry	2.55
Louisiana	61.9	+ 1.8	Shriever, Donaldsonville	89	7, 9, 19	Plain Dealing, Ruston	29	1, 25	8.39	+3.80	Clinton	21.47	Shreveport	2.89
Maryland and Delaware	49.3	+ 8.1	Boettcherville, Md.	85	20	Grantsville, Md.	15	2	5.16	+1.36	Bachmans Valley, Md	9.36	Green Sulphur Springs, Md.	3.09
Michigan	37.4	+ 9.4	Adrian	80	18, 19	Ironwood	— 4	1	1.86	—0.67	Detour	5.07	Owosso	0.20
Minnesota	29.6	+ 4.7	New Ulm	69	18	Mount Iron	—16	1	1.75	+0.44	Grand Meadow	3.62	Mount Iron	0.48
Mississippi	60.0	+ 3.3	Duck Hill	86	10	Ripley	27	25	6.47	+0.88	Woodville	14.98	Hernando	2.98
Missouri	46.8	+ 4.8	Jefferson City, New Haven.	81	17	Warrenton	9	1	3.34	0.00	Lamar	8.63	Conception	0.85
Montana	27.0	— 1.6	Troy, Miles City	70	24, 30	Culbertson	—18	20	0.95	—0.09	Summit	6.85	Livingston	0.01
Nebraska	35.8	+ 1.6	Fort Robinson	89	31	Agate	—11	20	0.72	—0.43	Genoa	2.17	2 stations	T.
Nevada	38.7	— 0.1	Rioville	90	30	Potts	— 8	18	1.41	+0.35	Beowawe	5.36	Hawthorne	T.
New England	40.8	+ 9.8	Mount Tom, Mass.	89	20	Fort Fairfield, Me.	—17	3	5.95	+2.43	Bar Harbor, Me.	10.05	Chatham, N. H.	2.95
New Jersey	47.6	+ 8.9	Indian Mills	79	20	Ringwood	13	2	5.13	+1.00	Woodbine	8.53	Pemberton	3.60
New Mexico	43.3	— 0.4	Carlsbad	90	13	Winsors	—17	1	0.48	—0.01	Taos	1.40	4 stations	T.
New York	41.4	+10.8	Avon	81	19	Axton	— 1	3	4.59	+1.60	Cutchogue	7.51	Youngstown	2.27
North Carolina	56.1	+ 7.5	Fayetteville	83	20	Linville	17	2	7.48	+2.87	Highlands	17.52	Currituck Inlet	2.12
North Dakota	22.1	+ 4.5	Coal Harbor	80	31	McKinney	—24	20	0.55	—0.39	Hamilton	1.58	2 stations	T.
Ohio	46.7	+ 7.8	Portsmouth	85	19	Hudson	11	2	3.51	+0.22	Coalton	6.10	Findlay	1.62
Oklahoma and Indian Territories	49.8	+ 0.1	Clifton, Okla.	90	31	Kenton, Okla.	—13	1	2.73	+0.50	Goodwater, Ind. T.	6.01	Kenton, Okla.	0.10
Oregon	42.6	— 0.3	Grants Pass	78	22	Joseph	— 2	8	4.09	—0.26	Glenora	14.93	Umatilla	0.28
Pennsylvania	46.4	+10.4	California	83	18	Dyberry	14	2	4.52	+0.67	Pottsville	5.81	Erie	2.82
Porto Rico	74.2	— 0.1	Manati	93	28	Adjuntas	44	13	2.34	—0.64	Morovis	6.13	Coamo	T.
South Carolina	60.4	+ 5.9	Yemassee	84	21	Clemson College	26	1	5.92	+2.16	Batesburg	11.14	Bowman	1.53
South Dakota	31.4	+ 2.9	Chamberlain	77	31	Pedro	—15	20, 24	1.18	—0.20	Spearfish	3.98	2 stations	0.29
Tennessee	54.9	+ 6.2	Liberty	83	19	Rugby	18	2	5.77	—0.08	Decatur	12.12	Waynesboro	3.44
Texas	57.4	— 1.5	Camp Eagle Pass, Fort McIntosh.	93	31	Amarillo	— 2	1	3.21	+0.53	Rockport	11.21	3 stations	T.
Utah	37.3	— 0.3	St. George	80	30	Woodruff	—32	1	1.19	—0.34	Kanab	5.55	Green River	0.02
Virginia	51.8	+ 6.7	Barboursville	81	15	Burkes Garden	16	2	5.79	+2.06	Callaville	9.85	Stephens City	3.63
Washington	40.0	— 1.9	Mottingers Ranch	78	24	Conconully	— 2	12	3.45	+0.38	Brinnon	10.72	2 stations	0.25
West Virginia	51.3	+ 8.6	Byrne, Charleston	87	20, 20	Nuttallburg, Travellers Repose	13	2	4.47	+0.54	Dayton	6.59	Old Fields	2.70
Wisconsin	36.6	+ 8.6	Milwaukee, Prairie du Chien	75	18, 19	Hayward	— 8	8	2.34	+0.56	Green Bay	3.75	Hayward	0.82
Wyoming	29.2	+ 0.2	Basin	72	28	Border	—33	1	0.94	—0.36	South Pass City	2.60	Basin	T.

tion, except along the Gulf coast, where the rainfall was very heavy. Killing frosts occurred on the 1st very generally, except in the coast district and the southeastern counties, and on several dates during the last decade in the northern counties, doing serious injury to the fruit crop, especially peaches. Owing to the wet condition of the soil farm work made slow progress prior to the last decade, when it advanced very rapidly, and cotton planting was begun in the northern and was general in the central and southern portions of the State; corn planting was practically completed and coming up, except in the northern portion, to fairly satisfactory stands; planting of sugar cane in progress and gardening completed. At the close of the month wheat, rye, and oats were in fine condition, grass was growing very fast and beginning to afford excellent pasturage.—*Don V. Burney.*

Utah.—Farm work during the month was generally limited to plowing, which began during the last decade. Fall grain and alfalfa made a good start. The fruit buds passed through the winter without suffering damage, but were showing no signs of opening at the close of the month. The grass has started on the ranges, but feed was scarce and stock generally in poor condition.—*L. H. Murdoch.*

Virginia.—The weather of the month was unusually favorable for crop growth, but on account of excessive precipitation field work was retarded. Fall sown wheat and oats came through the month in fine condition, especially in the valley section, where locally the growth was from 8 to 10 inches. Spring oats were seeded, came up, and were doing well at the close of the month. A plentiful supply of tobacco plants. Fruit trees blooming heavily.—*Edward A. Evans.*

Washington.—Month cool and, on the whole, unfavorable for growth and development of staple crops. The ground was frozen so much of the time and snow continued so late that spring seeding and plowing were scarcely under way until the last week. The fruit buds were not developed, which has probably saved them from frost and cold rains. There was some slight damage to winter wheat by freezing, but it was generally in good condition. The spring is three weeks late.—*G. N. Salisbury.*

West Virginia.—Mild weather prevailed during March, and, at the close of the month, wheat, rye, and oats were in much better condition than usual at this time of the year; grass was making rapid growth, and some stock had been turned out to pasture; considerable plowing had been done, some oats and potatoes seeded, and some gardens made; fruit buds were swelling, but little damage was done by the frost of the last week.—*E. C. Vose.*

Wisconsin.—The month was unusually warm, and vegetation made an excellent start, especially in the southern portion of the State. Wheat and rye suffered but little from winter killing, and clover appeared to have sustained less injury than usual. Considerable plowing and seeding was done during the latter part of the month.—*W. M. Wilson.*

Wyoming.—The only severe storm of the month was on the 18th, when heavy snow was quite general over the State, yet some sections received very little snow then; the storm was followed by a moderate cold wave. The spring is backward. Stock losses have been heavy in some sections, and only normal in other sections.—*W. S. Palmer.*

SNOWFALL AND WATER SUPPLY IN THE ROCKY MOUNTAIN REGION.

The following extracts are taken from the snow bulletins for February, 1903, prepared by the Section Directors of Climate and Crop sections in the Rocky Mountain region:

Colorado.—March was not so stormy as usual over the greater part of the mountain region, and, taken as a whole, the precipitation was below normal, although local excesses were noted in nearly every watershed. Considerable snow has melted in the valleys, and a large proportion of the moisture is being absorbed by the dry soil. Above 9000 feet the depths are practically the same as a month ago, the current fall generally making good the loss in depth by the gradual settling of the old snow, much of which is in a condition to remain late in the season. The outlook for a good and prolonged flow is unusually favorable for the Rio Grande; on other watersheds the early flow promises to be much better than last year's, but the late flow will be less than normal if not augmented by rainfall.

Idaho.—At the close of March the measurements showed that the amounts on the ground were in excess of the average in nearly all sections. With a few localities excepted, an abundance of water for irrigation is assured.

Montana.—On March 31 the prospects for a good flow of water, which, from present indications, will last until late in the season, were very favorable throughout the greater portion of the State. There are some localities in which the snowfall has been below the average, or in which the snow is not drifted or firm, and somewhat less than a normal waterflow is anticipated; however, they comprise a small portion of the State.

Nevada.—The depth of snow in the mountain ranges on March 31, 1903, was very much greater than it was at the close of the corresponding month last year. There was but little or no loss of snow from melting on account of the low day and night temperatures which prevailed during February and the greater part of March. Indications are favorable for plenty of irrigation water in all districts the coming summer.

New Mexico.—At the close of March the snow had all melted in the lower valleys, but there were some patches on northern sides of the lower mountains. On the higher ranges, at the headwaters of the Canadian, Pecos, and the New Mexico streams tributary to the Rio Grande, the depth of unmelted snow ranged from 3 to 6 feet, with the deep canyons of the northern sides filled with hard packed snow, thus insuring a lasting and steady supply for the upper valleys of these streams far into the summer. On the summits of the White and Sacramento mountains the greatest depth was probably about 5 feet, with the canyons well filled; and about the same conditions obtained at the headwaters of the Gila and San Francisco rivers. Throughout the southwestern sections, at the lower altitudes, rains during the latter part of March and the 1st of April, rapidly melted the snow, in some cases causing damaging flood waters. Throughout the territory the soil was in an unusually moist condition, with the streams running bank full and a steady supply to draw on.

Utah.—The precipitation during the month was about normal. The depth of snow in the mountains of all the watersheds of the State is generally greater than usual and exceeds that for any season since the winter of 1896–97. Most of the snow fell during November, December, and January. It has therefore had plenty of time to drift and pack, and is now in splendid condition to withstand the warm weather. The temperature conditions during March were about normal, and only a moderate amount of melting occurred. The depth of snow and its drifted and well packed condition assure all sections of the State an abundant supply of irrigation water throughout the coming crop season.

Wyoming.—The March snowfall was in excess of the normal throughout most of the State, thus adding to the supply of snow which will be available for irrigation during the coming summer. The outlook for water for late summer irrigation is more favorable than it has been at this season of the year since the spring of 1899. The late snows over the eastern slope of the Big Horn Mountains has brought the supply in that section up to or above the normal, and streams of that section should carry more water the coming season than during the past three seasons. The southern half of the State has a good supply of snow in the mountains, the depths being greater than usual over almost every section and excessive in many sections. This assures a good water supply for the coming summer over the Laramie, Platte, Green, and Snake River watersheds, even though the late spring snowfall should be deficient and the early summer unusually warm.

SPECIAL CONTRIBUTIONS.

CLIMATOLOGY OF THE ISTHMUS OF PANAMA.

By General HENRY L. ABBOT.

Since it now appears probable that the Government of the United States will soon begin operations to complete a ship canal connecting the waters of the Atlantic and Pacific oceans by cutting through the Isthmus of Panama, public attention can not fail to be attracted to the region in question, where for more than twenty years two private companies have successively been engaged in prosecuting the work under serious difficulties both financial and climatic. During this long period they have collected much valuable data respecting the climate which, tropical in character and differing widely from any in the United States, deserves to be carefully studied in advance by parties proposing to take an active part in the great work. Certain portions of this information have already appeared in the MONTHLY WEATHER REVIEW, but in view of present conditions it has seemed to me desirable to prepare a summary bringing these records up to date, with an analysis designed to develop the information they convey. This is attempted in the following paper.

MONTHLY VARIATIONS IN TEMPERATURE.

In considering the climate of the Isthmus, as compared with that of more temperate regions, attention is attracted by the remarkable uniformity of temperature throughout the year. This is illustrated in Table 1, chiefly extracted from Bulletin No. 22 (serial No. 163), of the United States Weather Bureau, published in 1898.

The general elements which determine this uniformity are the direct heat received from the sun; the influence of the excessive volume of aqueous vapor held in suspension in the atmosphere; the influence of the two great seas which wash the shores of the narrow belt of land constituting the Isthmus. The influence of the seas depends on their varying absolute temperatures and on the movements of the atmosphere, as these, in a large measure, regulate the effect of the oceans in different months. The available statistics, collected chiefly by the two Panama Canal companies, throw much light upon the relative influence of these several agencies, and are sufficiently complete to warrant an attempt at a mathematical study of the problem, with a view to a thorough understanding of the climate. Each element will be considered in turn.

TABLE 1.

Localities.	Approximate latitude.	Years of observation.	Average temperature.				Max. recorded.
			Annual.	Hottest month.	Coldest month.	Difference.	
	°		° F.	° F.	° F.	° F.	° F.
Washington	39	25	54.7	76.9	33.2	43.7	104
New Orleans	30	25	68.8	82.4	53.3	29.1	99
Key West	25	21	77.5	84.4	70.5	13.9	.....
Assuan or Wadi Halfa	23	.....	80.0	94.8	64.0	30.8	119
Habana	23	10	76.8	82.4	70.3	12.1	101
San Juan, P. R	18	12	78.8	81.5	75.7	5.8	101
Kingston, Jamaica	18	10	78.1	81.1	74.6	6.5	.....
Barbados	13	20	75.6	76.9	73.4	3.5	.....
Cayenne	4	1	79.7	82.0	77.1	4.9	.....
Manila	15	17	80.0	84.0	77.0	7.0	100
Isthmus of Panama	9	26	79.7	81.0	78.3	2.7	99

Monthly mean temperatures, as determined from hourly observations, refer to the middle of each month. Hence, the relative intensity of the solar energy received during the month may be regarded as proportional to the sine of the altitude of the sun at noon, and its relative duration as proportional to the length of the time that it is above the horizon on that day. In latitude 9° north, the sun at noon is at the zenith twice during the year, once on April 13 when it is journeying northward to reach its summer solstice on June 21, and again on August 29, when returning toward its winter solstice, which it reaches on December 21. The direct heat transmitted at these altitudes is then proportional to the sines of 90°, 75° 41′, and 57° 24′, or to the numbers 1.00, 0.97, and 0.84 for the zenith, the summer solstice, and the winter solstice, respectively. It is, however, to be noted that the length of day, and hence the duration of solar radiation, attains its maximum in June and its minimum in December; and that this element therefore tends to reduce the natural fall of temperature during the northward journey of the sun, and to augment it dur-

ing the approach to his southern limit. The numerical values of these several elements for each month are given in the first six columns of Table 2.

But the temperature of the air, as registered by the thermometer, is affected by the modifying influence of the aqueous vapor held in suspension, which opposes great resistance to the energy radiated from the sun by day, and still more to that radiated back from the earth both by day and by night. By day this vapor tends to largely reduce, and by night to largely increase, the temperature of the air at the earth's surface. Unfortunately a trustworthy estimate of the numerical value of this varying vaporous element is far more difficult than for solar radiation; but its influence can not be ignored in the study, although the available data can only be regarded as approximate. The actual measurements on the Isthmus consist of observations for one year, made by the old canal company at Colon in 1881, and for eight months at this place by the United States Weather Bureau from October, 1898, to May, 1899. Both series indicate as is usual in similar climates, a decided excess in the months of heavy rains; the former series gives a mean relative humidity of 0.77 for January, February, March, and April, but of 0.86 for the rest of the year; the corresponding figures of the Weather Bureau are 0.83 and 0.88. It would seem therefore that the best available estimate to adopt for relative humidity is a mean between the two series of measurements, giving 0.80 in the four dry months, 0.87 in six of the rainy months, and 0.83 in the intermediate months of December and May.

In introducing this element into the study it is needful to note that the effect of aqueous vapor in suspension upon the temperature of the air at the earth's surface is reversed every twelve hours. By day it tends to reduce the reading of the thermometer by absorbing part of the solar radiation, and to increase it by checking radiation from the earth; but as the former is much the more potent agency the aggregate influence is to reduce the reading. In other words, the resulting temperature is inversely proportional to a function of the aqueous vapor in suspension. By night the effect is wholly to increase the reading of the thermometer, by checking terrestrial radiation. In other words, the resulting temperature is then directly proportional to some function of this quantity. Although it is well known that the obstructive action in question is much less effective against solar than against terrestrial radiation, no coefficient applicable to the entire atmosphere has been established. It is, however, to be noted that in using the same numerical value for relative humidity by day and by night a corrective coefficient is virtually introduced, since by day the computation deals with the difference between the two opposing radiations and by night with only one of them. Furthermore, absolute humidity is less by night than by day.

TABLE 2.—*Influence of sun and humidity on temperature for the middle day of each month.*

Month.	Latitude, 9° north.			Relative length of—		Relative humidity.	Effective ratios by—	
	Sun rises.	Sun sets.	Altitude at noon.	Day.	Night.		Day.	Night.
	h. m.	h. m.	° ′					
January	6 22	5 58	S. 59 53	0.917	0.993	0.80	0.991	0.794
February	6 23	6 07	S. 68 01	0.927	0.983	0.80	1.075	0.786
March	6 06	6 13	S. 78 54	0.958	0.952	0.80	1.175	0.762
April	5 51	6 10	N. 89 13	9.974	0.936	0.80	1.218	0.749
May	5 41	6 12	N. 80 07	0.990	0.920	0.83	1.175	0.764
June	5 41	6 20	N. 75 41	1.000	0.909	0.87	1.114	0.791
July	5 52	6 19	N. 77 28	0.984	0.925	0.87	1.105	0.805
August	5 53	6 14	N. 84 57	0.976	0.933	0.87	1.118	0.812
September	5 52	5 57	S. 84 01	0.955	0.955	0.87	1.092	0.831
October	5 50	5 41	S. 72 28	0.937	0.973	0.87	1.026	0.846
November	5 55	5 34	S. 62 29	0.921	0.989	0.87	0.940	0.860
December	6 10	5 41	S. 57 43	0.911	1.009	0.83	0.928	0.830

Table 2 exhibits the numerical values of the elements entering into the study, and, in the last two columns, the resulting ratios indicating the relative influence upon monthly mean temperatures exerted jointly by the sun and by humidity. The values by day represent the products of the sine of the sun's altitude at noon by the relative length of day, divided by relative humidity; by night they represent the product of the relative length of night by relative humidity. If these ratios be multiplied by such numbers as will give an annual mean temperature similar to that actually observed, or by 24.5 for day and 32.7 for night, the results will be scales of monthly means representing the relative combined effect of the agencies in question in the several months. Such figures appear in Table 7.

It remains to consider the influence of the two oceans bordering the Isthmus. The old canal company made daily observations of the temperature of the water at Colon and at Naos for four years, from 1884 to 1888. The monthly means appear[1] in Table 3. The general movements of the atmosphere, which in a large measure determine the influence of oceans upon neighboring shore climates, are here governed by the locus of the ascending current of warm air which follows the sun in its travels north and south between the solstices. When the sun is north of the Isthmus southerly winds prevail, and when south, northerly winds. Observations upon the direction of the movement were made daily at Colon by the old canal company at 6 a. m., 1 p. m., and 9 p. m., during the year 1881, and the results were confirmed in a general manner by more elaborate measurements made there for eight months in 1898–99 by the United States Weather Bureau. The resulting percentage of winds blowing from the sea during each month are given in Table 3, together with the effective monthly departures from the annual mean ocean temperature, the latter being the product of the observed departures by these percentages. The final column for each ocean gives a scale of monthly mean ocean temperatures representing for each month the relative effective influence upon the shore climate, found by adding to the annual mean the effective monthly departures.

TABLE 3.—*Influence of adjacent seas on Isthmian temperature.*

Month.	Caribbean Sea.				Bay of Panama.			
	Water temperature.	Per cent of sea breeze.	Effective departure.	Active temperature.	Water temperature.	Per cent of sea breeze.	Effective departure.	Active temperature.
	°C.		°C.	°C.	°C.		°C.	°C.
January	24.5	99	−1.8	24.5	21.9	00	0.0	24.5
February	24.3	98	−2.0	24.3	19.9	00	0.0	24.5
March	25.0	95	−1.2	25.1	20.6	01	0.0	24.5
April	25.2	90	−1.0	25.3	23.3	04	0.0	24.5
May	26.0	45	−0.1	26.2	25.4	40	+0.4	24.9
June	27.0	27	+0.2	26.5	25.7	51	+0.6	25.1
July	27.4	36	+0.4	26.7	25.5	53	+0.5	25.0
August	27.6	38	+0.5	26.8	26.1	51	+0.8	25.3
September	27.7	31	+0.4	26.7	26.5	56	+1.1	25.6
October	27.4	01	+0.1	26.4	26.7	74	+1.6	26.1
November	27.2	21	+0.2	26.5	26.6	67	+1.4	25.9
December	26.6	78	+0.2	26.5	26.1	12	+0.2	24.7
Means	26.3	.....	.....	26.0	24.5	.....	.....	25.0

Before combining these several elements of the problem it is not without interest to compare them with each other when still in the form of ratios indicating for each its relative calorific influence in the different months. These ratios are shown in Table 4, and by fig. 1. For the two oceans additional ratios are added, showing their relative actual temperatures in the different months, with a view to developing the fact that, while the great equatorial current of warm water entering the Caribbean Sea largely modifies the direct action of the sun upon its temperature, the Pacific on the other side, where no such cur-

[1] At Colon the annual average was 79.3° F., the maximum, 81.9°, occurring in September and the minimum, 75.8°, in February. At Naos these figures were 76.1°, 80.0° occurring in October, and 67.8° in February.

rent exists, becomes a great natural thermometer to register the direct heat received but with a retardation of about two months, both in maximum and minimum, representing the time required to influence the temperature of so large a volume of water. This is shown to the eye on fig. 1 by comparing the two ocean temperature curves with those showing the direct solar influence. The other curves in like manner show how the two oceans combine to lower the temperature of the air on the Isthmus as the sun approaches his first zenith transit, and later to largely augment it in October, November, December, and January, when without such agency the entire region would experience a sensible fall in the thermometer.

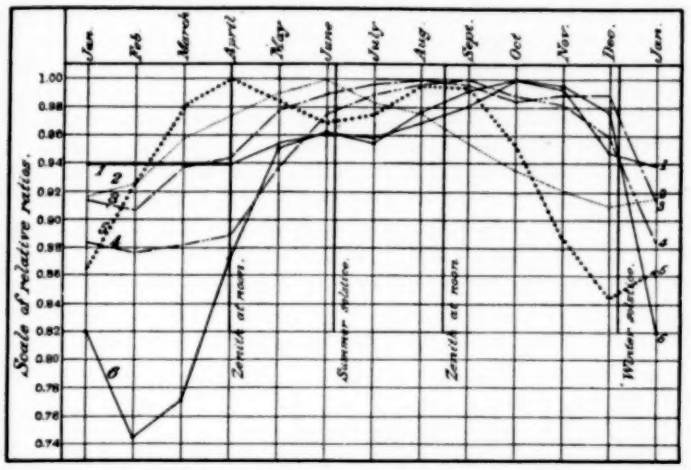


Fig. 1.—Relative influence of different factors upon the monthly temperatures on the Isthmus of Panama. (1) Influence of the Pacific Ocean (see Table 4, column 7); (2) Influence of the length of the day (see Table 4, column 3); (3) Influence of the Atlantic Ocean (see Table 4, column 5); (4) Temperature of the Caribbean Sea (see Table 4, column 4); (5) Intensity of the solar radiation (see Table 4, column 2); (6) Temperature of the Bay of Panama (see Table 4, column 6).

TABLE 4.—*Relative monthly influences.*

Month.	Solar radiation.		Caribbean Sea.		Bay of Panama.	
	Intensity.	Duration.	Actual temperature.	Effective temperature	Actual temperature.	Effective temperature.
January ...	0.865	0.917	0.884	0.914	0.820	0.939
February ..	0.927	0.927	0.877	0.907	0.745	0.939
March	0.981	0.958	0.882	0.937	0.772	0.939
April	1.000	0.974	0.889	0.944	0.873	0.939
May	0.985	0.990	0.938	0.978	0.951	0.954
June.....	0.969	1.000	0.975	0.989	0.963	0.962
July	0.976	0.984	0.989	0.996	0.955	0.958
August	0.996	0.976	0.996	1.000	0.977	0.969
September.	0.995	0.955	1.000	0.996	0.993	0.981
October....	0.953	0.937	0.989	0.985	1.000	1.000
November .	0.887	0.921	0.982	0.989	0.996	0.993
December..	0.845	0.911	0.960	0.989	0.977	0.947

It now remains to combine the several elements, with a view to learn how the resulting mean temperatures of the different months compare with those actually observed. This is done in Table 7; but before considering it, it is desirable to examine the actual observations made throughout the region, and to combine them in such a manner as to deduce the general monthly means affecting the Isthmus of Panama. These appear in Table 5, which briefly recapitulates the records given in full in an article on the Climatology of the Isthmus of Panama, Weather Bureau serial No. 201, with all later additions, including December, 1902. Table 6 presents a summary of the hourly observations made by the Weather Bureau at Bridgetown, Barbados, Port of Spain, Trinidad, and Willemstad, Curaçao, during the two years 1899 and 1900, added to illustrate the effect of the comparative absence of the Pacific Ocean upon climate, at about the same altitude and latitude as that of the Isthmus.

TABLE 5.—*Observed air temperatures on the Isthmus.*

Month.	Colon, 92 months.	Gamboa, 88 months	Alhajuela, 39 months.	Panama, 9 months.	La Boca, 41 months.	Naos, 70 months.	Mean.	
	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°F.
January.....	26.25	24.10	24.96	26.17	26.20	26.60	25.71	78.28
February.....	26.18	23.60	26.06	26.25	26.79	26.15	25.84	78.51
March.....	26.47	24.15	26.55	26.62	27.25	26.33	26.23	79.21
April	26.48	24.90	27.05	27.25	27.69	27.65	26.84	80.31
May	26.73	26.85	25.55	27.07	27.01	27.90	26.85	80.33
June	26.73	27.70	26.21	26.69	27.23	28.85	27.23	81.01
July.....	26.77	26.75	26.02	.....	26.69	28.31	26.91	80.44
August.....	26.23	26.60	26.20	.....	26.10	28.00	26.63	79.93
September.....	26.57	27.15	25.97	.....	26.46	27.94	26.82	80.28
October	26.18	26.55	25.46	26.45	25.84	27.45	26.32	79.38
November	26.10	26.80	25.60	26.01	25.79	26.80	26.18	79.12
December	26.47	25.75	25.76	25.78	26.48	26.80	26.17	79.11
Means	26.43	25.91	25.95	26.48	26.63	27.40	26.48	79.66

TABLE 6.—*Observed air temperatures near sea level, north shore of South America.*

Month.	Barbados.			Trinidad.			Curaçao.			Mean.	
	1899.	1900.	Mean.	1899.	1900.	Mean.	1899.	1900.	Mean.		
	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°C.
January	76.2	79.9	78.0	76.3	77.9	77.1	77.3	79.8	78.1	77.73	25.41
February ...	75.7	77.5	76.6	76.4	77.5	77.0	76.9	78.7	77.8	77.13	25.08
March	76.0	77.8	76.9	76.8	78.2	77.5	77.0	78.4	77.7	77.37	25.21
April	77.7	79.4	78.6	78.0	79.4	78.7	78.9	80.1	79.5	68.93	26.08
May	79.4	80.0	79.7	79.6	79.2	79.4	79.8	81.3	80.5	79.87	26.60
June.....	79.6	80.1	79.8	78.6	78.1	78.4	80.5	82.1	81.3	79.83	26.58
July	80.3	80.2	80.3	79.1	.....	79.1	81.4	81.3	81.4	80.27	26.82
August	80.8	80.6	80.7	79.5	80.2	79.9	81.9	82.4	82.1	80.90	27.10
September..	80.7	80.9	80.8	79.9	79.7	79.8	82.8	82.4	82.6	81.07	27.21
October	80.0	80.0	80.0	80.6	79.5	80.0	82.0	81.8	81.9	80.63	26.93
November ..	80.0	79.2	79.6	79.0	78.4	78.7	81.5	80.3	80.9	79.73	26.52
December...	78.2	79.9	79.0	78.3	79.0	78.7	79.3	79.7	79.5	79.07	25.08
Means ..	78.7	79.6	79.2	78.3	78.7	78.7	79.9	80.6	80.3	79.39	26.30

The results of this analysis of the mean monthly temperatures of the Isthmus are presented in Table 7, of which the first four columns recapitulate the typical scales discussed above. The fifth column is derived from them by taking a mean between the mean for day and night and the two ocean scales, and subtracting 0.69 of a degree in order to reduce the annual mean to that shown by the observations. Then follows a column showing discrepancies between analysis and observation. The last three columns repeat the results, in degrees Fahrenheit, to which the coastwise average is added for convenience of comparison.

TABLE 7.

Month.	Active elements in °C.				Resultants, °C.			Temperature in °F.		
								Isthmus.		
	By day.	By night.	Caribbean Sea.	Pacific.	Computed.	Observed.	Difference.	Comp'd.	Obs'd.	South American coast.
	°	°	°	°	°	°	°	°	°	°
January	24.29	25.96	24.50	24.50	25.40	25.71	+0.31	77.72	78.28	77.73
February	26.34	25.70	24.30	24.50	25.63	25.84	+0.21	78.13	78.51	77.13
March	28.80	24.92	25.10	24.50	26.18	26.23	+0.05	79.12	79.21	77.37
April	29.84	24.49	25.30	24.50	26.35	26.84	+0.49	79.43	80.31	78.93
May	28.80	24.98	26.20	24.90	26.69	26.85	+0.16	80.04	80.33	79.87
June.....	27.29	25.87	26.50	25.10	26.75	27.23	+0.48	80.15	81.01	79.83
July	27.04	26.30	26.70	25.00	26.81	26.91	+0.10	80.26	80.44	80.27
August	27.38	26.54	26.80	25.03	27.04	26.63	−0.41	80.67	79.93	80.90
September	26.75	27.17	26.70	25.60	27.11	26.82	−0.29	80.80	80.28	81.07
October	25.14	27.68	26.40	26.10	26.99	26.32	−0.67	80.58	79.38	80.63
November	23.03	28.13	26.50	25.90	26.68	26.18	−0.50	80.02	79.12	79.73
December.....	22.74	27.15	26.50	24.70	26.07	26.17	+0.10	78.93	79.11	79.07
Means	26.45	26.23	26.00	25.00	26.48	26.48	0.31	79.66	79.66	79.39

The small discrepancies shown in this table, averaging to only 0.31 of a degree centigrade, regardless of sign, with a maximum of only half a degree, between the indications derived from an analysis of the forces in action and the results of numerous and well distributed observations would seem to warrant the belief that the former are determined with suf-

ficient accuracy to make known their respective agencies in modifying the climate of the Isthmus. The curves on fig. 2 present to the eye the data contained in the more important columns of the table. If the direct action of the sun as modified by humidity alone be considered, there would be a range of monthly mean temperature of about 3.75° between the sun's first zenith transit in April and the middle of December; but this is reduced by the influence of humidity by night and by that of the two oceans to an observed range of 2.51° between June and January and to a computed range of 1.64° between the sun's August transit of the zenith and January. On the northern shore of South America the observations

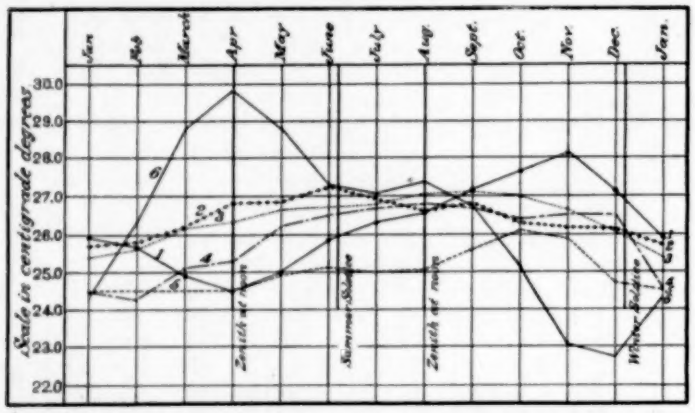


Fig. 2.—Absolute influence of different factors upon the monthly temperatures on the Isthmus of Panama. (1) Influence of the humidity of the air during the night-time (see Table 7, column 3); (2) The observed temperature (see Table 7, column 7); (3) The computed temperature (see Table 7, column 6); (4) Temperature of the Caribbean Sea (see Table 7, column 4); (5) Temperature of the Bay of Panama (see Table 7, column 5); (6) Influence of humidity and sunshine by day (see Table 7, column 2).

indicate a range of 2.13° between that transit and February, which is the coolest month, perhaps from the elimination of the influence of the Pacific. The curves indicating the influence of the two oceans show that the Atlantic is much the more important, and the close resemblance, shown by fig. 3, between the temperatures prevailing on the Isthmus and on the northern shore confirm this conclusion. The northerly winds prevailing in the first four months of the year effectually prevent the Pacific, then relatively cold, from moderating the temperature at Panama. The joint influence of varying humidity and varying length of night is a more powerful factor in effecting the nearly unvarying annual temperature of the Isthmus than perhaps has been appreciated hitherto.

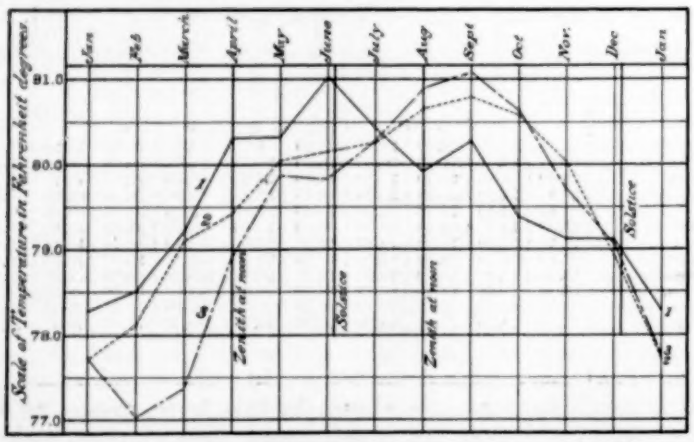


Fig. 3.—Comparison of monthly mean temperatures. (1) Isthmus of Panama, observed, 399 months (see Table 7, column 10); (2) Influence of Panama, computed, (see Table 7, column 9); northern coast of South America, 71 months (Curaçao, Trinidad, Barbados; see Table 7, column 11).

DIURNAL VARIATION IN TEMPERATURE.

The change in temperature from hour to hour is next to be considered. Observations with thermographs of the Richard type were made by the new Panama Canal company at Panama from October, 1897, to June, 1898, and at Alhajuela and La Boca nearly continuously from July, 1899, to the present date. The United States Weather Bureau made similar observations at Colon from October, 1898, to May, 1899. As all these records indicate great uniformity in diurnal variations it seems superfluous to encumber this paper with the figures in detail. A careful analysis has demonstrated that characteristic differences exist only between the Gulf coast, the interior, and the Pacific coast, and between the four dry months—January, February, March, and April—and the remaining eight months, when heavy rains prevail. Table 8 exhibits these differences in the form of general means of all the observations, to include February, 1903. As most of them were recorded in centigrade degrees, they are so given. It should be noted that, as the Weather Bureau records refer to the time of the seventy-fifth meridian, a subtraction of nineteen minutes must be made to compare them with the others, which refer to local time. This has been done on fig. 4, illustrating the table.

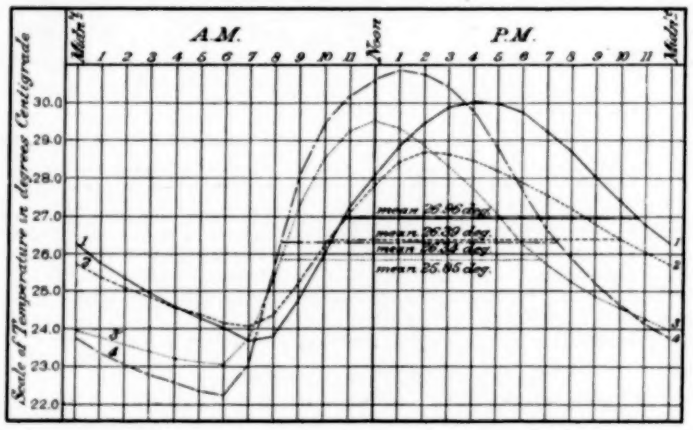


Fig. 4.—Observed diurnal variation of temperature (local time) in the dry and the wet seasons. (La Boca, dry season (see Table 8, column 5); (2) La Boca, rainy season, (see Table 8, column 9); (3) Alhajuela, rainy season (see Table 8, column 6); (4) Alhajuela, dry season (see Table 8, column 30).

Table 9 presents the results of similar observations made by the United States Weather Bureau at Bridgetown, Barbados, and Willemstad, Curaçao, added to permit of a comparison with the climate near sea level on the northern shore of South America. To reduce to local time, an addition of sixty-two minutes and twenty-four minutes, respectively, must be made, as has been done on fig. 5, which illustrates the table. The above records at Alhajuela and La Boca are repeated in the Fahrenheit scale to facilitate comparison by annual means, monthly differences in rainfall being less pronounced on the north shore than on the Isthmus.

As is the case with monthly means, the changes of temperature from hour to hour and from day to day are subject to much less variation on the Isthmus than in regions more remote from the equator; and, therefore, Tables 8 and 9 convey a more definite idea of the climate than would similar compilations for localities in the United States. It should, however, be remembered that they are based on observations made where the thermometers were not subjected to direct solar radiation; laborers exposed to the sun would experience much higher temperatures.

Figs. 4 and 5 exhibit so clearly the horary changes characterizing the climate in the interior of the Isthmus, on the Pacific coast, and on the northern shore of South America, that little need be added.

TABLE 8.—*Hourly variations in temperature in centigrade degrees.*

Hour.	Dry season, January–April.				Rainy season, May–December.			
	Colon, 4 months.	Alhajuela, 12 months.	Panama, 4 months.	La Boca, 14 months.	Colon, 4 months.	Alhajuela, 29 months.	Panama, 5 months.	La Boca, 29 months.
1 a. m.	25.28	23.37	25.18	25.76	24.65	23.82	25.80	25.38
2 a. m.	25.22	23.08	24.97	25.33	24.40	23.62	25.70	25.10
3 a. m.	25.08	22.80	24.75	24.94	24.20	23.43	25.56	24.83
4 a. m.	25.02	22.58	24.59	24.60	24.00	23.25	25.45	24.59
5 a. m.	24.82	22.37	24.45	24.30	23.88	23.13	25.37	24.39
6 a. m.	**24.75**	**22.25**	24.31	24.02	**23.85**	**23.07**	**25.26**	24.16
7 a. m.	25.00	23.04	**24.27**	**23.71**	24.20	23.78	25.29	**24.07**
8 a. m.	25.70	25.58	24.66	23.82	25.25	25.35	25.62	24.37
9 a. m.	26.82	28.05	25.85	24.75	26.58	27.29	26.20	25.21
10 a. m.	27.47	29.43	27.05	26.00	27.48	28.56	26.78	26.23
11 a. m.	27.98	30.20	27.88	27.23	28.05	29.28	27.24	27.11
Noon	**28.22**	30.64	28.32	28.08	28.40	**29.54**	27.40	27.82
1 p. m.	28.10	**30.85**	28.55	28.87	**28.40**	29.34	27.48	28.43
2 p. m.	27.85	30.75	28.82	29.50	28.32	28.90	**27.56**	**28.70**
3 p. m.	27.68	30.40	29.22	29.91	27.82	28.35	27.50	28.66
4 p. m.	27.42	29.81	**29.28**	**30.05**	27.52	27.78	27.40	28.48
5 p. m.	26.88	28.83	28.97	30.00	26.98	27.09	27.18	28.22
6 p. m.	26.35	27.71	28.45	29.77	26.25	26.29	26.96	27.92
7 p. m.	26.02	26.67	27.67	29.24	25.82	25.70	26.72	27.57
8 p. m.	25.98	25.90	26.95	28.71	25.70	25.27	26.52	27.22
9 p. m.	25.75	25.21	26.45	28.02	25.40	24.88	26.36	26.79
10 p. m.	25.70	24.65	26.02	27.41	25.20	24.56	26.22	26.41
11 p. m.	25.60	24.18	25.65	26.77	25.05	24.28	26.06	26.05
Midnight	25.50	23.78	25.38	26.29	24.85	23.99	25.92	25.72
Mean	25.26	26.34	26.57	26.96	25.93	25.85	26.40	26.39
Maximum	30.60	34.50	31.60	35.20	32.20	35.90	32.10	32.90
Minimum	20.60	18.00	22.00	20.00	20.60	18.90	23.80	20.00

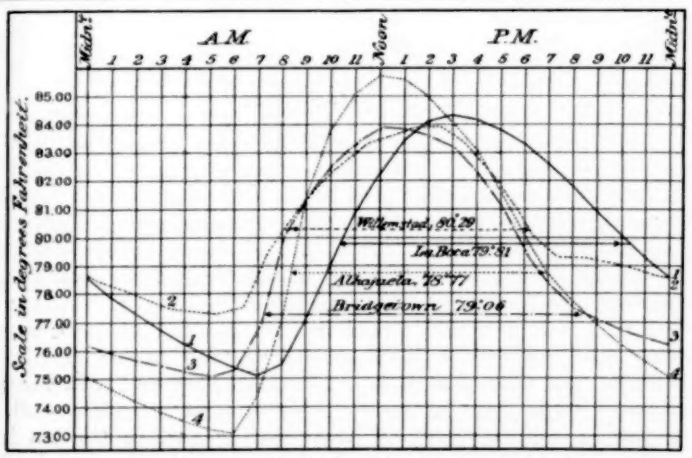


Fig. 5.—Observed diurnal variations of temperature (local time) for the whole year. (1) La Boca (see Table 9, column 5); (2) Willemstad (see Table 9, column 3); (3) Bridgetown (see Table 9, column 2); (4) Alhajuela (see Table 9, column 4).

Alhajuela is situated in the valley of the upper Chagres, among the hills which here represent the great mountain chains bordering the western coast of North and South America. Its altitude above tide is only 144 feet, and being about midway between the oceans the locality is well suited to represent the climate of the interior of the Isthmus. The temperature at sunrise in the dry season is about 72°; it soon rises rapidly, attaining about 87° at 1 p. m.; after this it falls rapidly to about 81° at sunset, and then subsides gradually to the minimum at sunrise. During the rainy season the temperature at sunrise is about 74°; it rapidly reaches a maximum at noon, about 85°, and then falls to about 80° at sunset, and later to the minimum at sunrise. Thus, during the dry season the daily temperature has a larger range and a later maximum than when rains prevail.

At La Boca, situated on the Bay of Panama, the minimum temperature occurs later, or at about an hour after sunrise, being then about 75° in both the dry and the rainy seasons. The maximum in the dry season, 86°, is reached at about 4 p. m., and in the rainy season, 84°, at about half past 2 p. m. The rate of fall is more gradual than at Alhajuela, the mercury receding at sunset in the dry season only to about 86°, and in the rainy season only to about 83°. In short, the changes on the Pacific coast are less extreme and are later than in the interior, but the daily average is about the same.

TABLE 9.—*Annual hourly variations, Isthmus and north shore, in Fahrenheit degrees.*

Hour, 75th meridian time.	Bridgetown, Barbados, 24 months, 1899–1900.	Willemstad, Curaçao, 24 months. 1899–1900.	Hour, local time.	Alhajuela, 41 months. 1898–1903.	La Boca, 43 months. 1898–1903.
1 a. m.	75.66	78.06	1 a. m.	74.64	77.90
2 a. m.	75.43	77.80	2 a. m.	74.23	77.32
3 a. m.	75.28	77.62	3 a. m.	73.85	76.77
4 a. m.	**75.19**	77.52	4 a. m.	73.51	76.28
5 a. m.	75.37	**77.44**	5 a. m.	73.24	75.85
6 a. m.	76.98	77.63	6 a. m.	**73.09**	75.40
7 a. m.	80.10	79.44	7 a. m.	74.41	**75.11**
8 a. m.	81.60	80.84	8 a. m.	77.13	75.54
9 a. m.	82.70	81.84	9 a. m.	81.52	77.11
10 a. m.	83.41	82.62	10 a. m.	83.86	79.07
11 a. m.	**83.93**	83.28	11 a. m.	85.17	80.87
Noon	83.90	83.61	Noon	**85.75**	82.24
1 p. m.	83.65	83.95	1 p. m.	85.60	83.43
2 p. m.	83.15	**84.00**	2 p. m.	84.99	84.12
3 p. m.	82.21	83.51	3 p. m.	84.11	**84.33**
4 p. m.	81.12	82.68	4 p. m.	83.08	84.18
5 p. m.	79.44	81.33	5 p. m.	81.68	83.84
6 p. m.	78.27	80.09	6 p. m.	80.08	83.34
7 p. m.	77.58	79.48	7 p. m.	78.76	82.62
8 p. m.	77.16	79.29	8 p. m.	77.81	81.86
9 p. m.	76.81	79.05	9 p. m.	76.96	80.94
10 p. m.	76.55	78.92	10 p. m.	76.26	80.11
11 p. m.	76.25	78.65	11 p. m.	75.65	79.30
Midnight	75.95	78.42	Midnight	75.09	78.62
Mean	79.06	80.29	Mean	78.77	79.84

NOTE.—Observations by the new company are recorded in local time; those of the United States Weather Bureau in thes eventy-fifth meridian time.

Unfortunately the observations at Colon, and at Panama as well, do not cover an entire year, which renders a comparison by seasons uncertain. The averages, however, show that no material difference in climate exists on any part of the Isthmus.

Fig. 5 is interesting in showing that the Alhajuela type of horary change, early minimum and maximum and rapid rate of variation, prevails at Barbados and Curaçao, and hence that the wide difference at La Boca must be attributed to the influence of the Pacific. On the contrary, the daily range at Barbados is identical with that at La Boca, while that at Curaçao is less than either, being only about 6° or 7°, as compared with 11° or 12° in the interior of the Isthmus. Nights averaging 3° or 4° cooler are a distinct advantage for the canal.

ANNUAL RAINFALL.

In connection with the study of comparative temperature on the Isthmus and on the Caribbean shore of South America, the fact that the rainfall at the latter is much less should be noted. During the period of the above observations the average annual rainfall was, at Alhajuela, 103.8 inches; at La Boca, 74.5 inches; at Barbados, 39.6 inches; at Trinidad, 56.5 inches; and at Curaçao only 16.1 inches.

Weather Bureau serial No. 201, including its appendix (or the MONTHLY WEATHER REVIEW, May, 1899), contains all rainfall records collected on the Isthmus prior to the date of its preparation in 1898, and these are therefore not repeated here. The accompanying Table 10 completes the list and includes all of March, 1903, the figures being recorded, as observed, in millimeters. Table 11 contains a summary in inches of all the observations. The number of essentially complete years at each station is indicated in brackets in the headings. In all cases the monthly means include all the observations. In computing the annual totals for years where only a month or two are missing, the gap has been supplied by the mean of all observed months of the same name at the station. Such interpolations in Table 10 are included in brackets, and for the earlier records they may easily be added in the reprint,[2] serial No. 201.

[2] Errata for Weather Bureau serial No. 201: Page 4, 7th line from bottom, for "southeast" read southwest. Page 5, 2d line from top, for "91" read 51. Page 9, 2d line from top, omit "on the coast." Page 13, 10th line from bottom, for "report" read connection. Page 15, Table 14, December 1887, for "16.28" read 12.68.

TABLE 10.—*Rainfall in millimeters, recent records.*

COLON.

Month.	1898.	1899.	1900.	1901.	1902.	1903.	Means.
January	128	176	154	33	489	25	167
February	9	165	9	24	15	7	38
March	40	32	29	42	59	25	38
April	120	11	19	38	113	.....	60
May	326	353	311	157	282	.....	286
June	416	163	296	281	178	.....	267
July	556	703	427	253	427	.....	473
August	277	376	433	318	147	.....	310
September	260	420	238	302	280	.....	300
October	289	382	415	321	358	.....	353
November	312	368	515	831	323	.....	470
December	202	229	105	138	188	.....	172
Total	2935	3378	2951	2738	2859	.....	2934

GAMBOA.

January	70	127	26	9	340	17	118
February	3	44	4	6	4	3	11
March	0	34	3	5	111	8	27
April	36	36	82	20	241	.....	83
May	135	217	172	276	[277]	.....	200
June	118	223	309	195	160	.....	201
July	468	240	341	234	159	.....	288
August	512	278	227	352	214	.....	317
September	104	342	236	214	226	.....	224
October	221	202	308	359	328	.....	284
November	370	221	271	485	365	.....	342
December	61	68	20	170	57	.....	75
Total	2098	2032	1999	2325	2482	.....	2170

BOHIO.

January	314	238	179	41	567	87	238
February	32	114	12	42	23	6	38
March	77	83	26	61	24	31	50
April	269	28	73	46	131	.....	109
May	371	263	188	431	[353]	.....	313
June	502	376	468	306	141	.....	359
July	888	451	451	500	144	.....	487
August	973	330	356	616	210	.....	497
September	338	226	391	611	317	.....	377
October	717	491	468	535	424	.....	527
November	554	265	635	869	332	.....	531
December	162	157	102	296	133	.....	170
Total	5197	3022	3349	4354	2799	.....	3696

ALHAJUELA.

January	.....	.....	46	5	[19]	5	19
February	.....	.....	1	1	9	[4]	4
March	.....	.....	1	46	10	10	17
April	.....	.....	104	64	144	.....	104
May	.....	.....	259	403	[331]	.....	331
June	.....	.....	453	305	230	.....	329
July	.....	297	501	202	325	.....	331
August	.....	259	268	454	240	.....	305
September	.....	205	437	404	270	.....	329
October	.....	301	337	566	286	.....	372
November	.....	274	339	546	474	.....	408
December	.....	48	29	124	115	.....	79
Total	.....	.....	2775	3120	2453	.....	2628

LA BOCA.

January	.....	.....	19	[50]	132	14	55
February	.....	.....	0	[0]	1	0	1
March	.....	.....	0	[40]	79	1	30
April	.....	.....	57	[94]	132	.....	94
May	.....	.....	285	183	251	.....	240
June	.....	.....	226	195	138	.....	186
July	.....	.....	402	248	136	.....	262
August	.....	.....	152	137	106	.....	132
September	.....	156	.....	229	172	.....	186
October	.....	304	.....	288	271	.....	288
November	.....	227	.....	372	290	.....	296
December	.....	110	.....	94	72	.....	92
Total	.....	.....	.....	1930	1780	.....	1862

GORGONA.

January	87	96	67	.....	.....	.....	83
February	5	51	3	.....	.....	.....	20
March	0	84	5	.....	.....	.....	30
April	35	.....	80	.....	.....	.....	58
May	128	.....	180	.....	.....	.....	154
June	111	.....	317	.....	.....	.....	214
July	470	.....	501	.....	.....	.....	486
August	505	.....	281	.....	.....	.....	393
September	[344]	.....	286	.....	.....	.....	286
October	196	.....	303	.....	.....	.....	249
November	244	.....	[264]	.....	.....	.....	244
December	100	117	[139]	.....	.....	.....	108
Total	2225	.....	2426	.....	.....	.....	2325

TABLE 11.—*Rainfall, in inches, consolidated table to February, 1903.*

Month.	Atlantic coast.		Pacific coast.				Means.	
	Colon. [32]	Bohio. [6]	Panama. [4]	Naos. [7]	Taboga. [3]	La Boca. [4]	Atlantic. [38]	Pacific. [18]
January	3.89	9.34	0.70	0.50	0.17	1.97	6.62	0.83
February	1.44	1.50	0.73	0.08	0.00	0.03	1.47	0.21
March	1.58	2.29	1.56	0.35	0.00	1.35	1.94	0.86
April	4.32	4.94	2.84	1.71	0.81	3.72	4.63	2.27
May	12.04	13.90	7.58	4.77	6.34	9.81	12.97	7.12
June	13.50	13.31	7.86	5.49	8.16	8.23	13.40	7.44
July	16.70	18.13	7.58	4.29	6.15	10.17	17.42	7.05
August	15.13	20.50	6.81	4.78	7.12	5.39	17.82	6.03
September	12.68	16.73	7.48	7.42	7.33	7.31	14.70	7.38
October	14.15	20.44	9.49	6.64	7.32	11.12	17.30	8.64
November	20.69	20.15	11.57	6.26	4.05	10.43	20.42	8.08
December	12.14	9.25	2.75	3.21	6.56	4.78	10.70	4.33
Total	128.26	150.48	66.78	45.50	54.01	74.51	139.39	60.24

Month.	Interior stations.					
	Alhajuela. [3 years]	Gamboa. [20]	Gorgona. [3]	Bas Obispo. [10]	Culebra. [5]	Means. [41]
January	0.75	2.41	3.28	1.76	0.86	1.81
February	0.16	0.68	0.60	0.42	0.23	0.42
March	0.75	0.88	1.17	0.83	0.28	0.78
April	4.09	3.21	2.37	2.69	1.95	2.86
May	13.03	10.88	11.57	10.95	12.00	11.69
June	12.95	9.53	9.30	11.69	10.23	10.74
July	13.03	10.09	13.26	8.83	7.57	10.56
August	12.01	12.86	14.22	9.78	8.86	11.55
September	12.95	10.94	13.53	12.20	9.13	11.75
October	14.64	13.03	11.25	10.45	11.71	12.22
November	16.07	12.25	10.38	10.61	11.26	12.11
December	3.11	6.62	5.48	9.05	11.19	7.09
Total	103.54	93.38	96.41	89.26	85.27	93.58

It is evident from Table 11 that an annual rainfall of about 140 inches may be expected on the Atlantic coast, about 93 inches in the interior, and about 60 inches near the shores of the Pacific. There is a well-defined dry season beginning in December and including the months of January, February, March, and part of April, a period during which the sun is returning northward from his southern journey to the Tropic of Capricorn, and the locus of heavy rainfall has been transferred southward from the Isthmus. This comparative exemption from rain is characteristic of the interior and of the Pacific coast, but somewhat less so of the region bordering the Caribbean Sea. Clearly it is an important advantage to be able to depend upon having several consecutive dry months in which to prosecute the laying of concrete and other difficult work during the construction of the canal.

BAROMETRIC PRESSURE.

Since the date of Weather Bureau serial No. 201, reprinted from the MONTHLY WEATHER REVIEW for May, 1899, continuous observations with a Richard barograph have been made at Alhajuela by the new Panama Canal company from July, 1899, to date, except in May, 1902; and the Weather Bureau made a similar series at Colon from October, 1898, to May, 1899. The heights of the instruments above tide were at Alhajuela, 144 feet, and at Colon, 25 feet. These records accord with the earlier data in demonstrating the great uniformity of pressure throughout the Isthmus. The extreme range at Alhajuela during nearly four years has been only 0.44 inch, the maximum reading, 30.11 inches, being noted in February, 1900, and the minimum, 29.67 inches, in November, 1902, both reduced to sea level and corrected for instrumental error; the corresponding mean reading is 29.904 inches. If this uniformity had been understood, much use of the barometer might have been made to determine heights in the preliminary reconnaissances, which the dense undergrowth rendered exceptionally difficult.

The horary variations in barometric pressure are best studied in the form of departures from the mean reading, which enable a direct comparison to be made between the curves in the dry and the rainy seasons. This is done in Table 12, and is shown to the eye on fig. 6. The figures cover the entire record at Alhajuela from July, 1899, to December, 1902, inclusive. It will be noted that the same characteristic differences between the temperature curves in the two seasons, shown in Table 8 and fig. 4, reappear in barometric pressure. The barometric readings in this table are given as recorded, without correction.

TABLE 12.—*Horary barometric pressure, in millimeters.*

Hours.	Dry season.		Rainy season.		Hours.	Dry season.		Rainy season.	
	Means.	Departures.	Means.	Departures.		Means.	Departures.	Means.	Departures.
1 a. m.	760.48	−0.49	760.20	−0.48	2 p. m.	758.59	+1.40	758.41	+1.31
2 a. m.	760.26	−0.27	759.94	−0.22	3 p. m.	758.27	+1.72	758.23	+1.49
3 a. m.	760.10	−0.11	759.79	−0.07	4 p. m.	758.23	+1.76	758.29	+1.43
4 a. m.	760.10	−0.11	759.82	−0.10	5 p. m.	758.43	+1.54	758.51	+1.21
5 a. m.	760.28	−0.29	759.99	−0.27	6 p. m.	758.90	+1.09	758.94	+0.78
6 a. m.	760.62	−0.63	760.28	−0.56	7 p. m.	759.43	+0.56	759.42	+0.30
7 a. m.	760.94	−0.95	760.59	−0.87	8 p. m.	759.93	+0.06	759.88	−0.16
8 a. m.	761.11	−1.12	760.74	−1.02	9 p. m.	760.36	−0.37	760.26	−0.54
9 a. m.	761.03	−1.04	760.64	−0.92	10 p. m.	760.65	−0.66	760.49	−0.77
10 a. m.	760.64	−0.65	760.24	−0.52	11 p. m.	760.78	−0.79	760.55	−0.83
11 a. m.	760.18	−0.19	759.78	−0.06	Midnight	760.71	−0.72	760.42	−0.70
Noon.	759.68	+0.31	759.24	+0.48					
1 p. m.	759.15	+0.84	758.79	+0.93	Mean ..	759.99	0.00	759.72	0.00

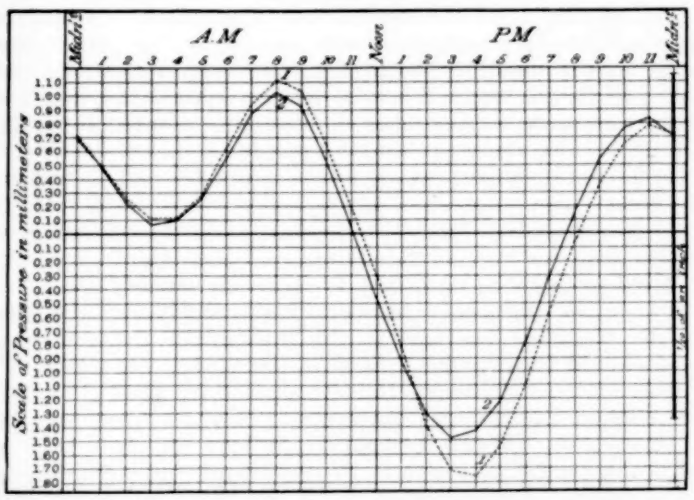


Fig. 6.—Diurnal curve of barometric pressure at Alhajuela. Dotted line, mean of the four dry months for three years; mean pressure, 759.99 (see Table 12, column 3). Full line, mean of eight rainy months for four years; mean pressure, 759.72 (see Table 12, column 5).

WINDS OF THE ISTHMUS.

During seven months, from October, 1898, to May, 1899, the United States Weather Bureau made continuous observations upon the velocity of the wind at Colon, using a Robinson anemometer, the height of the instrument being 47 feet above ground. Directions were also noted at 8 a. m. and 8 p. m., and the results accord well with those noted by the old canal company in 1882, and reported in Weather Bureau serial No. 201, reprinted from the MONTHLY WEATHER REVIEW for May, 1899.

These velocity observations are specially valuable, as they constitute the only direct measurements ever reported on the Isthmus. They show during the whole period a great uniformity from day to day and from month to month, the wind increasing gently from about six miles per hour at midnight to about eight and a half miles at two or three o'clock in the afternoon, and then subsiding gradually. The strongest winds came from the Caribbean Sea, usually attaining a velocity of about 20 miles per hour, and on one occasion a velocity of 24 miles.

TABLE 13.—*Summary of wind at Colon.*

Month.	Total.	Mean velocity.	Strongest wind.	Estimated direction.
	Miles.	*Miles.*	*Miles.*	°
October, 1898	4123	5.5	20 w.	s. 25 e.
November, 1898	3907	5.4	20 nw.	s. 55 e.
December, 1898	5276	7.1	20 ne.	n. 39 e.
January, 1899	4946	6.6	16 ne.	n. 33 e.
February, 1899	4931	7.3	24 nw.	n. 19 e.
March, 1899	5765	7.7	20 ne.	n. 34 e.
May, 1899 *	3386	7.1	20 nw.	n. 26 e.

* Eleven days missing.

HEALTH ON THE ISTHMUS.

The health statistics during the construction of the Panama Railroad have never been made public, but are well known to have been appalling. At that date it was not understood that natives of the temperate regions can not safely perform arduous manual labor under exposure to a tropical sun, and that dependence for such work must be placed upon the negroes of the West Indies. White men can supervise, but must not attempt more. Fortunately the health records during the canal operations, and especially those during the operations of the new company, which should furnish the best guide in view of the great changes in the physical condition of the region, have been preserved, and are shown in Table 14, contributed by Dr. Lacroisade, for many years the medical director of the fine company hospital near Panama. He is thoroughly familiar with the Isthmian conditions, and the notes following the table are a translation from a letter written by him on March 9, 1902, and published in The Medical News, vol. 80, p. 707, New York, 1902. His views on this important subject are entitled to the highest confidence. He attributes the marked improvement, shown in Table 14, to the better accommodations of the laborers, to better drainage, and especially to the fact that the excavations have reached a level below the poisonous emanations of decaying organic matter. The period of serious sickness, always to be expected in tropical regions, has apparently already been passed at Panama. It is interesting to note that whereas the percentages of disease and of mortality for general ailments have remained sensibly unchanged during three suc-

TABLE 14.—*Official health statistics of the Panama Canal.*

Years.	Effective force employed.	Percentage of disease.			Percentage of mortality.		
		Diseases of Europe.	Diseases due to climate.	Total.	Diseases of Europe.	Diseases of climate.	Total.
Old company:							
1881	928	21.02	42.03	63.04	1.94	4.74	6.68
1882	1,910	18.85	47.64	66.49	3.21	4.39	6.60
1883	6,267	23.24	42.62	65.86	3.20	4.46	6.66
1884	17,615	27.58	36.95	64.57	2.58	4.08	6.66
1885	15,215	11.93	49.14	61.07	1.73	3.79	5.52
1886	14,935	14.01	43.88	57.89	1.67	3.43	5.10
1887	16,217	21.83	39.25	61.07	3.22	3.99	6.21
1888	13,725	12.17	40.46	52.63	1.81	2.54	4.35
Mean	10,854	18.83	42.75	62.58	3.05	3.92	5.97
Receiver:							
1889	1,826						
1890	about 800						
1891							
1892							
1893							
1894							
Mean	971			49.68			2.88
New company:							
1895	1,225			49.95	2.05	0.89	2.94
1896	3,715			39.91	2.08	0.84	2.92
1897	3,980			51.85	1.99	1.00	2.99
1898	3,400	28.26	13.65	41.91	1.76	0.27	2.03
1899	2,500	19.76	5.84	25.60	2.24	0.12	2.36
1900	2,000	17.05	8.50	25.55	3.00	0.25	3.25
1901	2,000	18.60	6.85	25.45	1.55	0.20	1.75
Mean	2,703	20.92	8.71	37.17	2.10	0.51	2.61

cessive epochs, they have fallen enormously in the later years for diseases incident to the local climate.

1898.—Among the employees of the company there was no sickness of an epidemic character; the sanitary conditions were satisfactory.

On the Isthmus generally, a light epidemic of influenza prevailed during the months of January and February, but no yellow fever or other sickness of an epidemic form appeared.

1899.—Among the employees of the company there was a single case of yellow fever, contracted at La Boca, in November by a Frenchman recently arrived and employed on the harbor works. He recovered. There was no other sickness of an epidemic form among the employees of the company, and the sanitary condition was satisfactory.

In the City of Panama, between May and the middle of December, there were about 139 cases of yellow fever. Its victims were chiefly foreign sailors arriving in the bay and Colombian soldiers from the interior.

In June and July a rather severe epidemic of influenza occurred. In September a short epidemic of measles caused some deaths. The City of Colon appeared to be proof against yellow fever.

1900.—Among the employees of the company a single case of yellow fever occurred, terminating in recovery, and there was no other sickness of an epidemic form. The sanitary condition was satisfactory, notwithstanding the rather high death rate caused by a larger number than usual of deaths from chronic diseases of a general type.

On the Isthmus, generally, yellow fever, which had disappeared after the middle of December, returned in March. Between that date and September 10, about 138 cases occurred in Panama, of which 128 were among the Colombian soldiers from the interior. There was no other sickness of an epidemic form. The City of Colon escaped yellow fever.

1901.—No epidemic appeared among the employees of the company, and the sanitary condition was very satisfactory.

On the Isthmus, generally, yellow fever, of which no case had been reported since September 10, 1900, was again imported in January, 1901, by a priest and a sister of charity coming from Buenaventura. It was communicated to a sister of the orphan asylum of the central hospital and then to the superior. The latter alone recovered. These four were the only cases in January, 1901; and since then up to the present month (March, 1902) there has been no return of the disease.

In April, 1901, a serious epidemic of smallpox appeared in Panama and still continues. The employees of the company have suffered very little, a result which should be attributed to the numerous vaccinations which have been made.

The City of Colon appears always to escape these epidemics.

General conclusions.—Considering the average figures for the last four years, I find that with a personnel of 2275 the percentage of disease has been 29.65, and the mortality 2.35 per cent. These figures do not exceed those on large works in any country.

It should, however, be added that this personnel has been long on the Isthmus and is well acclimated; I may even say extremely so, since 91 per cent of the total death rate is due to chronic organic diseases common to all countries, leaving only 9 per cent of it chargeable to the diseases of the local climate.

The classified employees, which constitute about 8 per cent of the entire force, are represented in the total death rate by 5.70 per cent, while the laborers are represented by 94.30 per cent. The mortality in the latter class is therefore the greater.

Among infectious diseases on the Isthmus yellow fever is undoubtedly the most to be feared by unacclimated persons of the white race. During the two recent epidemics of yellow fever—the first from May to December 15, 1899, and the second from March to September 10, 1900—only two cases appeared among the personnel of the company. Both were French, one a workman on the wharf at La Boca who had been only a few days in the country, and the other the head nurse of the company's hospital who had held this position for two years. To these should be added the superior of the sisters at the hospital, attacked in January, 1901, after three or four months of residence, one of the four solitary cases of this month just mentioned. These three cases recovered. I attribute the last two cases to infection proceeding from the foreign hospital, which received a large number of the 261 cases occurring in the different epidemics and which, by its too close proximity, is a menace to the hospital of the company. The latter offers satisfactory sanitary conditions.

I have mentioned in former reports the disappearance of yellow fever from the Isthmus from the year 1892 to the year 1897. This would lead to the belief that the disease is in no wise necessarily endemic. In 1897, indeed, between the beginning of March and the beginning of August there were about 70 cases, as well at Panama as on a portion of the line of the canal, but no case occurred at Colon.

I will remark that the City of Colon, which up to about the years 1891–92, was a terrain than which nothing could be better for yellow fever—reputed more dangerous than the City of Panama—has since that time remained free from any infectious disease and has escaped the yellow fever epidemics of 1897, 1899, and 1900. This is evidently due to the sanitary works which have been executed, the filling up of the many little swamps and the cleaning of streets which before were veritable sewers. By these improvements the City of Colon has been considerably freed from the swarms of mosquitoes which rendered life insupportable.

Might not a like result be secured for the City of Panama (1) by a good supply of pure water, (2) by drains to conduct sewerage to the sea, to which its situation and conformation are easily adapted, and (3) by watering the streets daily in the dry season, and by cleaning them daily throughout the entire year. Now they are in a repulsive condition of filth. These three improvements, which I consider fundamental and essential, are now wholly neglected.

There should also be instituted an effective quarantine service for vessels arriving in the harbor, for beyond all doubt the epidemics of 1897, 1899, and 1900, and the few cases which occurred in January, 1901, were due to importations, in one instance from the Atlantic and in three instances from the Pacific.

I do not expect by these measures to remove completely from Panama its character as a terrain favorable for the propagation of yellow fever; but certainly, if thoroughly applied, they would exclude some epidemics and render a residence on the Isthmus less dangerous for unacclimated persons of the white race.

The important works executed from one end to the other of the line of the canal have also done much to improve the sanitary conditions existing on the Isthmus.

MEAN BAROMETRIC PRESSURE AT SEA LEVEL ON THE AMERICAN ISTHMUS.

By GENERAL HENRY L. ABBOT, dated Cambridge, January 27, 1903.

The series of meteorological observations made on the Isthmus by the new Panama Canal company now includes a continuous hourly record of barometric pressure at Alhajuela on the upper Chagres River since June, 1899, lacking only a single month, May, 1902. Unfortunately, an undetermined error in the reading of the barograph prevents this series from being available in connection with the numerous observations made by the Weather Bureau in the West Indies, and published in the MONTHLY WEATHER REVIEW; and it has, therefore, seemed to me to be desirable to determine it with all possible precision. As there are no facilities for a direct comparison with a standard barometer, resort must be had to indirect methods. The height of the instrument above mean tide (148 feet) is accurately known, together with the simultaneous hourly temperatures at the station. If then, the true reading of the barometer at mean sea level in this vicinity can be determined, the difference between this quantity and the mean of the recorded readings of the instrument reduced to sea level should furnish the desired instrumental correction.

The MONTHLY WEATHER REVIEW supplies all needed facilities for determining the true barometric reading at mean sea level in this region. It has furnished in full for the years 1899 and 1900 the hourly barometric pressure and corresponding air temperatures at various stations in the West Indies, of which the heights above sea level are recorded. Since hourly observations eliminate horary variations in pressure, and full annual series eliminate monthly variations, observations so long continued in a region of extraordinary uniformity of pressure can certainly be trusted to essentially eliminate abnormal variations, together with any small instrumental errors of instruments so carefully adjusted as those of the Weather Bureau. The probable error of a reading at mean sea level, thus deduced, should be insignificant. It remains to select the stations.

To eliminate gravity variations, the stations should lie as nearly as possible on the same parallel of latitude as Alhajuela. Four fulfill this condition, and all of them, fortunately, are but little elevated above the sea, thus favoring the needed reductions. Two of these stations are Willemstad, Curaçao, and Bridgetown, Barbados, at each of which two full years are available. At Port of Spain, intermediate between the two, the records cover ten months in 1899 and nine months in 1900. To utilize the nineteen available months, it is only needful to correct the error due to the missing months by interpolations, which may be found by adding to the partial annual means the difference between the mean for the corresponding months in the four complete years and their true annual means, and then adding to this for each missing month its departure on the 4-year curve. The fourth station is Colon, where, unfortu-

nately, only eight months are available in 1898 and 1899. No satisfactory method for interpolation for the missing months, where no annual mean is on record, has suggested itself, but the figures actually observed are given for comparison in Table 1 which sets forth the results of the study. To determine the weight which should be accorded to the final result, its probable error has been computed by applying the noted mean correction to each of the sixty-seven months, and proceeding in the usual manner. The probable error is found to be 0.0023 inches. It would appear, therefore, that 29.906 inches may be adopted with confidence as the desired mean reading at the level of mean tide in the region in question.

TABLE 1.—*Barometric pressure in inches, reduced to mean sea level.*

Month.	Bridgetown, 2 years.	Willemstad, 2 years.	Mean, 4 years.	Port of Spain, 19 months.	Mean, 3 stations.	Monthly corrections.	Colon, 8 months.
January	29.943	29.906	29.924	29.893	29.916	−0.010	29.842
February	29.990	29.933	29.962	29.937	29.953	−0.047	29.865
March	29.966	29.914	29.940	29.917	29.933	−0.027	29.874
April	29.948	29.873	29.910	29.902	29.907	−0.001	29.851
May	29.960	29.885	29.923	29.916	29.921	−0.015	29.857
June	29.964	29.892	29.929	29.932	29.930	−0.024	.....
July	29.938	29.888	29.913	29.903	29.910	−0.004	.....
August	29.926	29.871	29.898	29.904	29.907	−0.001	.....
September	29.923	29.860	29.892	29.903	29.895	+0.011	.....
October	29.878	29.824	29.851	29.949	29.850	+0.056	29.836
November	29.879	29.829	29.854	29.853	29.854	+0.052	29.868
December	29.913	29.882	29.897	29.915	29.903	+0.003	29.932
Annual mean	29.936	29.880	29.908	29.902	29.906	.....	29.866

NOTE.—The departure is subtracted from, or the correction is added to, the monthly reading in order to produce the annual mean.—ED.

It remains to determine the corresponding reading of the barograph belonging to the new Panama Canal company, which is given in Table 2 the missing reading for May, 1902, being interpolated from the curve of corrections in the manner indicated above.

TABLE 2.—*Barograph readings in millimeters at Alhajuela, reduced to mean sea level.*

Month.	1899.	1900.	1901.	1902.	Mean.	Monthly corrections.	
						Millimeters.	Inches.
January	.....	764.38	764.59	763.15	764.04	−0.53	−0.021
February	.....	764.46	763.96	763.95	764.11	−0.60	−0.024
March	.....	764.06	763.57	762.98	763.54	−0.03	−0.001
April	.....	763.64	762.83	762.48	762.98	+0.53	+0.021
May	.....	763.63	763.20	*762.65*	763.16	+0.35	+0.014
June	.....	764.06	763.16	762.09	763.10	+0.41	+0.016
July	763.63	764.53	763.15	762.74	763.51	0.00	0.000
August	763.07	764.29	763.28	762.51	763.29	+0.22	+0.009
September	763.64	764.70	763.58	762.88	763.70	−0.19	−0.007
October	764.28	764.17	762.88	763.64	763.74	−0.23	−0.009
November	763.27	764.21	763.94	763.60	763.83	−0.32	−0.013
December	763.73	764.12	762.25	763.35	763.16	+0.35	+0.014
Annual mean	763.60	764.21	763.37	763.00	763.51	.....	.....

NOTE.—The italic figures, May, 1902, indicate interpolation.—ED.

The mean reading deduced in the table is thus 763.51 millimeters. The mean of the three complete years is 763.53 millimeters, and the grand mean of all the months observed is 763.54 millimeters, all reduced to mean sea level. The desired correction to the barograph is, therefore, −3.90 millimeters.[1] Applying it to each of the forty-one months for which we have mean readings, corrected for monthly variation by the local curve of corrections, we have for the reading at mean sea level 759.61 ± 0.062, or 29.904 ± 0.002 inches. It would seem, therefore, that confidence may be accorded to this estimate of the desired correction. It may be added that as the reduction to the sea level only ranges from +3.74 to +3.78 millimeters, according to the observed readings and corresponding temperatures, the two corrections nearly balance each other, and the recorded reading of the barograph may be adopted as that at sea level with a trifling error, not exceeding 0.006 of an inch.

Incidentally, this study has thrown light on the question of mean monthly variation of barometric pressure. Table 3 recapitulates the above corrections for each month:

[1] See the note by Professor Bigelow on a subsequent page.—ED.

TABLE 3.—*Monthly variation in barometric pressure at sea level, in inches.*

Month.	The three stations long. 65°.	Alhajuela long. 80°.	Mean correction.
January	−0.010	−0.021	−0.015
February	−0.047	−0.024	−0.035
March	−0.027	−0.001	−0.014
April	−0.001	+0.021	+0.010
May	−0.015	+0.014	−0.001
June	−0.024	+0.016	−0.004
July	−0.004	0.000	−0.002
August	−0.001	+0.009	+0.004
September	+0.011	−0.007	+0.002
October	+0.056	−0.009	+0.024
November	+0.052	−0.013	+0.019
December	+0.003	+0.014	+0.008

These figures certainly indicate a remarkable uniformity of barometric pressure in this tropical region throughout the year, and tend to give confidence in the above conclusions.

NOTES ON A FEEBLE EARTHQUAKE RECORDED AT WASHINGTON, D. C.

By C. F. MARVIN, Professor of Meteorology.

A new seismograph was installed at the Weather Bureau in the latter portion of February and on the morning of March 15, 1903, the first slight earthquake was recorded. The seismograph will be fully described elsewhere in the MONTHLY WEATHER REVIEW.

The instrument is so installed that the record gives the horizontal component of motion in the north and south directions. The tracing index magnifies the movement of the earth ten times. The free period of oscillation (complete) of the steady mass was eighteen seconds at the time of the earthquake.

The record was perfectly inscribed and showed all the recognized characteristics of these phenomena. Section *C* of fig. 1 is a reproduction of a portion of the record showing the earthquake. The short, transverse strokes are minute marks made on the record electrically by a standard clock. At the time of the earthquake the clock was 8.5 seconds, viz: 0.14 minute, fast. Each line of the original sheet contains the record for sixty minutes, hence, the transverse strokes forming a somewhat irregular line across the sheet are corresponding minutes of successive hours. Thus, on the margin one mark is checked 3:38 p. m., March 14, 1903. The corresponding mark on the adjacent line is 4:38 p. m., and so on.

From the record the earthquake is seen to consist of three distinct portions, namely: First, the preliminary tremors from *a* to *b*; second, the main or principal portion, from *b* to *c*; and finally the terminal portion, beginning at *c* and extending some distance beyond the section of the record here reproduced. All earthquake records of this kind exhibit these marked characteristics, especially when the vibrations have traveled to a great distance from the origin of the disturbance. Near the origin the preliminary tremors are of short duration or may be absent altogether. The times of the different phases of the record are as follows:

March 15, 1903 (75th meridian time).

	H.	m.	s.
Preliminary tremors began	9	29	0
Duration of preliminary tremors		5	0
Principal portion began	9	34	0
Duration of principal portion		2	36
Beginning of terminal portion	9	36	36
End of tremors	10	3	0
Duration of terminal tremors		26	24
Total duration of disturbance		34	0
Strong vibrations at the maximum rate, comprising three full semivibrations, continued for a period of			19
Period of complete vibration at maximum			12.8
Maximum double amplitude of earth movement, 0.31 millimeter.			

The beginning of the principal portion is marked by several long-period oscillations of thirteen and one-half seconds, followed by shorter oscillations having about ten seconds period.

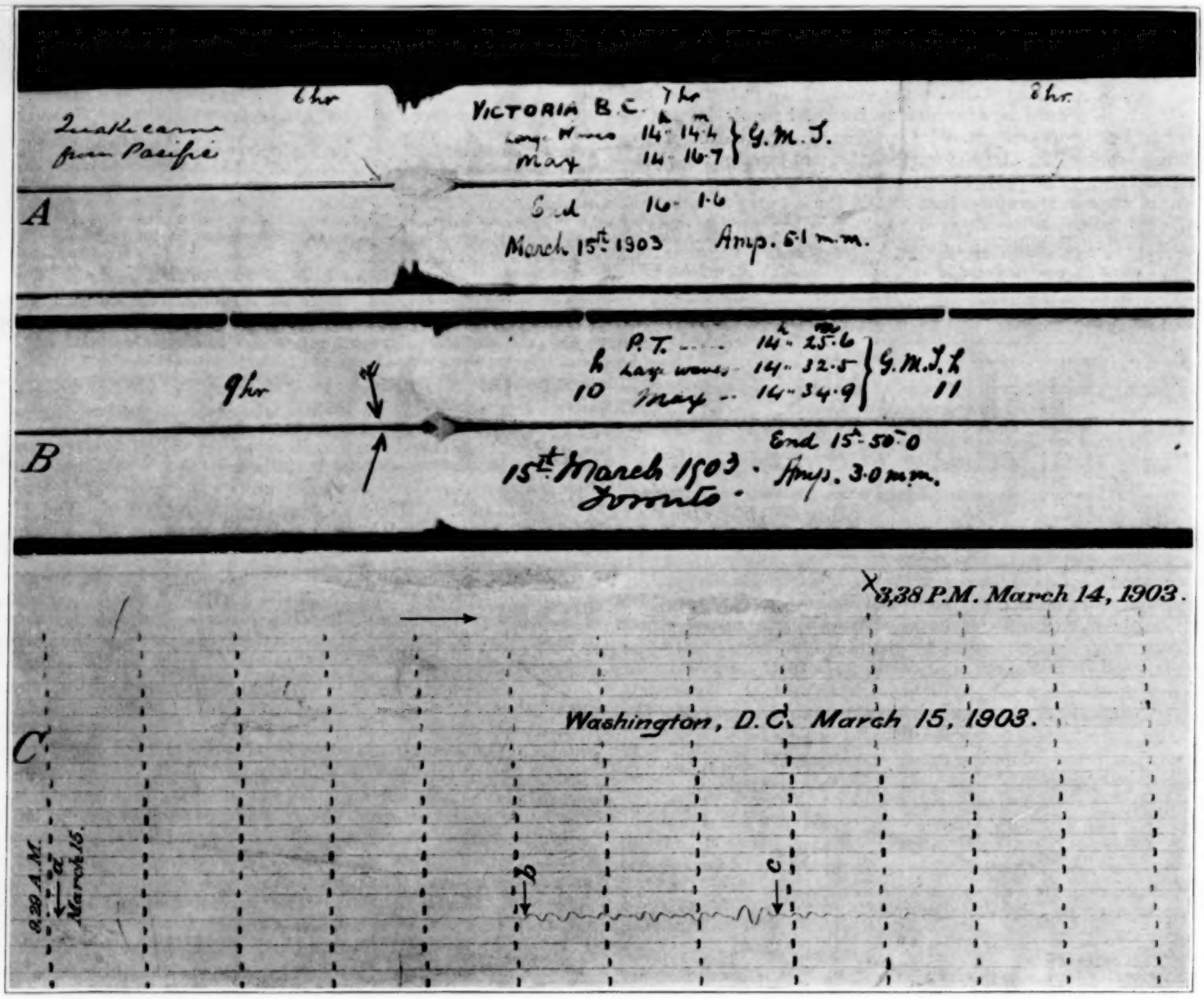

Victoria B.C.
Long waves 14h 14m 4 } G.M.T.
Max 14 16 7
End 16 1 6
March 15th 1903 Amp. 6·1 m.m.
P.T. 14h 25m 6
h Long waves 14 32 5 } G.M.T.
10 Max 14 34 9 } 11
End 15h 50m 0
15th March 1903 Amps. 3·0 m.m.
Toronto.
3,38 P.M. March 14, 1903.
Washington, D.C. March 15, 1903.
8.29 A.M. March 15.
a
b
c

FIG. 1—Seismograph records for March 15, 1903.

It is impracticable to determine the periods of the preliminary tremors, which, while perfectly definite on the original trace, are of extremely small amplitude.

Origin.—Very little can be said concerning the origin of this disturbance, but we learn that it was recorded on seismographs of the Milne type at Baltimore, Md., Toronto, Can., and Victoria, B. C.

Prof. R. F. Stupart of the Canadian Meteorological Office has kindly furnished copies of the records at Victoria and Toronto, which are reproduced in fig. 1, *A* and *B*, respectively.

The following table gives the times, in Greenwich mean time, of the principal features of the earthquake at the several stations:

Stations.	Preliminary tremors began.	Principal portion began.	Maximum waves.	End of tremors.
	h. m.	h. m.	h. m.	h. m.
Victoria, B. C.	None.	14 14.4	14 16.7	16 1.6
Toronto, Can.	14 25.6	14 32.5	14 34.9	15 50.0
Washington, D. C.	14 29.0	14 34.0	14 36.6	15 3.0

For purposes of comparison the moments of beginning of the strong waves in the principal portion are comparatively definite points. From these we find the time of transmission from Victoria to Toronto was 18.1 minutes, and from Toronto to Washington 1.5 minutes. The maximum waves are also fairly definite points and give us corresponding times of transmission of 18.2 and 1.7 minutes, respectively, which agree quite as closely as could be expected.

Taking the distance from Victoria to Toronto as 3500 kilometers we get 3.2 kilometers per second, for the speed of propagation of the stronger waves, which is very close to recognized values.

From a study of a large number of earthquakes in Japan and elsewhere, and of which good records were obtained in Europe and at great distances, Omori[1] found an empirical relation between the duration of the preliminary tremors and the distance of the origin, thus:

$$d = 14.9t - 24.9,$$

where d is the distance in kilometers and t the duration of the

[1] Report of the Earthquake Investigation Committee of Japan in foreign languages. No. 5.

preliminary tremors in seconds. In the present case the calculated distance is 4445 kilometers (2762 miles), a result which, without corroborative data, must be regarded as very problematic.

The reasoning in this case is to this effect: Earthquakes in general are caused, it is believed, by more or less sudden breaks or slips or fractures in the crust of the earth. Yielding of a gradual sort may have been going on for a long time before, but when the final fracture comes the phenomenon we call an earthquake results, and elastic and quasi-elastic waves of both compression and distortion and of a highly complex character radiate from the origin in all directions. The purely elastic vibrations within the elastic limits of the strata, and hence of smaller amplitude, are undoubtedly transmitted at a higher linear velocity than the great surges which doubtless strain the earth materials far beyond the elastic limit and are soon dissipated. Hence, we should expect the earthquake record to begin with preliminary tremors and this is found to be the case, except in very rare instances. The absence of preliminary tremors in the case of the present earthquake as recorded at Victoria would indicate a nearby origin for the disturbance.

A study of the records of distant earthquakes shows a most marked difference in the velocity of propagation of different phases of the phenomena. From Omori's investigations, already referred to, the *preliminary* tremors are transmitted at an average velocity of 12.8 kilometers per second; whereas, the large waves of the principal portion of the earthquake travel at the slow rate of only 3.3 kilometers per second. The theory of the speed of propagation of vibrations would require that the elastic properties of the strata should exceed those of steel in order to give the observed high velocities of the preliminary tremors.

A satisfactory explanation of this apparent conflict with our knowledge of the elastic properties of bodies has not yet been offered. A theory has been advanced that the preliminary tremors make a short cut for the distant station by traveling through the earth rather than around it, but even in this case the transmitting medium must have a very high modulus of elasticity.

THE DISTRICTS OF THE DOMINION OF CANADA.

In answer to many inquiries the Editor submits the accompanying sketch map, kindly furnished by Prof. R. F. Stupart, showing the names and locations of recent subdivisions in the Northwest Provinces of Canada.

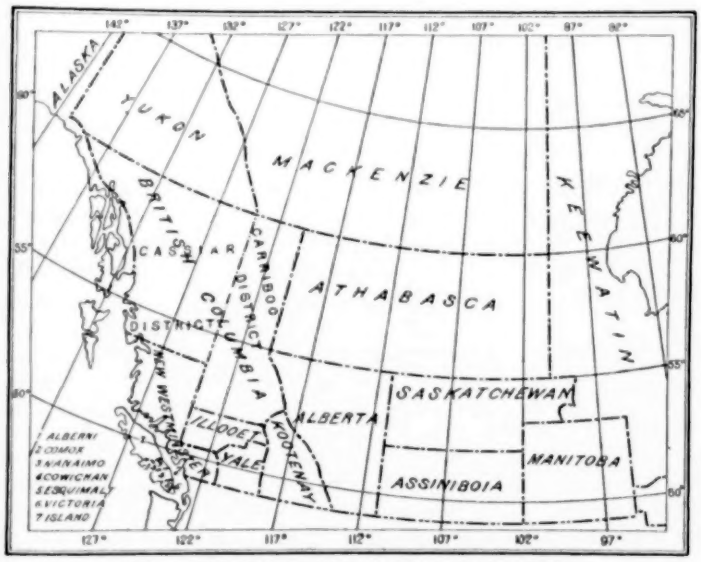


FIG. 1.—Districts of the Dominion of Canada.

THE SEMIDIURNAL TIDES IN THE NORTHERN PART OF THE INDIAN OCEAN.

By R. A. HARRIS, of the United States Coast and Geodetic Survey.

In this paper an attempt will be made to show by means of cotidal lines the average Greenwich lunar time of high water over the northern part of the Indian Ocean. Of course an unlimited number of sets of cotidal lines can be drawn which shall satisfy all reliable observations because the measurements of the tide have been confined to shores and islands. But unless one duly considers the causes and nature of the tide it is almost certain that such arbitrary lines will, when carried out far from land, represent an impossible state of affairs.

Before passing to the subject proper, it may be well here to call attention to the desirability of procuring more and better observations on many of the islands. Observations should also be made over shoals and, if possible, at places of greater depths.

It is the intention of the writer to cover the sea and all its principal arms with cotidal lines similar to those here shown in fig. 5. The maps showing such lines will probably also appear in an appendix to the United States Coast and Geodetic Survey Report for the year 1904. In view of this considerable delay, it is reasonable to suppose that the map accompanying this paper may by that time be modified somewhat in ways suggested by future observations and experience.

In fig. 5 Roman numerals denote the Greenwich lunar time of mean high water; when decreased by the east longitude of the place expressed in time they give its establishment in lunar hours. The Arabic numerals, generally scattered along the shores, denote the approximate mean range of tide in feet. Values given to tenths of a foot are based upon harmonic analyses; bracketed values indicate the range of the semidiurnal part of the tide where the latter is chiefly diurnal.

The northern part of the Indian Ocean is chosen for study at this time because the origin of the tide is there more easily accounted for than in most other regions, and because the results of extensive observations made by the survey of India, by the Dutch, and by the British Admiralty are available.[1]

In Appendix No. 7, United States Coast and Geodetic Survey Report for 1900, an attempt is made to partially explain the principal ocean tides. A preliminary sketch of parts of the theory involved in this appendix may be found in the MONTHLY WEATHER REVIEW for March, 1900, and this sketch should be consulted if the full paper is not available.

The Indian Ocean north of the thirtieth degree of south latitude is, with one exception, but little influenced by the tides of other waters. The exception is due to the fact that there is a good rise and fall around southern Africa, and in Mozambique Channel, where the tide depends upon two systems of oscillations which are determined by boundaries largely outside of the region to be considered in this paper. These systems, styled south Atlantic and south Indian, are described in Chapter VII of the Appendix No. 7 above referred to. It may be noted here that observations indicate about I.5 as the Greenwich lunar time of high water in Mozambique Channel, and that this is about the theoretical time of the tide, for it is a mean between XII or 0 and III; see fig. 1, which is taken from the chart of semidiurnal systems in the paper just referred to. Extending from Mozambique Channel to Baluchistan and India is a half-wave area whose time of tide, as will be noted later, is largely governed by the tide in the channel.

[1] Most of the data used in the construction of the accompanying map may be found in the British Admiralty Tide Tables; The United States Coast and Geodetic Survey Tide Tables; and Appendix No. 7, United States Coast and Geodetic Survey Report for 1900, sections 79–97 and figs. 25, 29.

THE NORTH INDIAN SYSTEM.

This system consists of the canal-like whole-wave area extending from the northwestern coast of Australia to the coast of Somaliland and Arabia, and of a dependent fractional area, viz, the Bay of Bengal. Since the eastern part of the whole-wave area has much greater depth than the western, there are some advantages in regarding the whole strip as two half-wave areas.

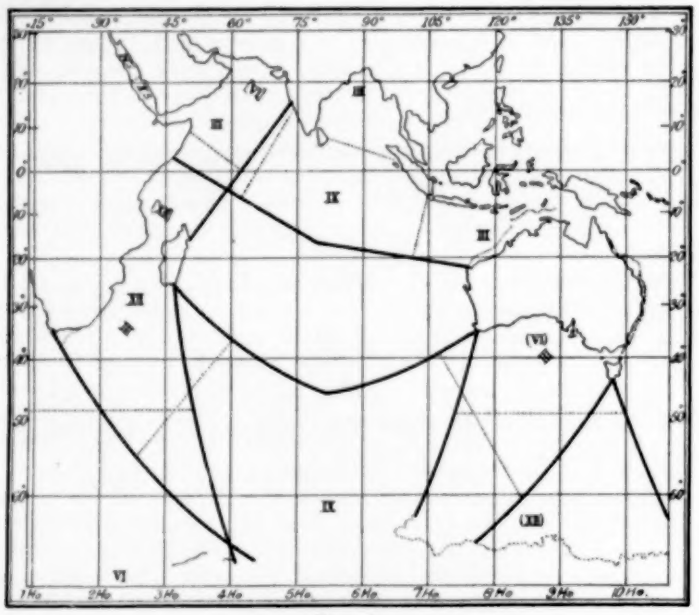


FIG. 1.

First of all it is required to ascertain the theoretical times of high water at the loops (i. e., ends and middle) of this strip by applying thereto arrows which denote the intensity and direction of the tidal forces at as many points as we find it necessary to take. In this instance the two points where the axis or central line crosses the two nodal lines will probably be sufficient. The positions of these points are about latitude $12\frac{1}{2}°$ south, longitude 103° east, and $3\frac{1}{2}°$ north, $67\frac{3}{4}°$ east, respectively. The trend of the axis of the eastern half of the canal is about south 75° east and of the western half, north 58° 40′ west. The free period of this body of water being reasonably close to a half lunar day for a binodal mode of oscillation, therefore the elongation of the particles, and the high or low water, must happen when the virtual work of the impressed periodic forces becomes zero.[2] For, as will appear from the inspection of fig. 2, the length and position of the canal are such that the forces tend to incite a considerable oscillation; that is, their effects are not continually nuetralized. At various assumed Greenwich lunar hours reduced to the local time by adding the east longitude, project the force arrows upon the axis of the canal.[3] Considering first the canal as uniform throughout its length, and supposing the forces to act upon equal masses undergoing equal but opposite displacements at the two nodes, the virtual work at any given time may be represented simply by the sum of the forces applied to the two nodes provided we regard those as positive which urge the water, say, toward the ends, and as negative those urging it from the ends toward the center. In fig. 2 the forces being applied only at the two nodes, are given equal weight; those acting on the western area are written to the left of the ordinate and those acting on the eastern are placed to the right. Forces directed westerly are represented by broken lines and easterly by full lines. The curve in fig. 2 may be regarded as representing the virtual work in the present instance for all hours because we can assume that at various times the magnitude of the arbitrary time element is so taken that at a given point the absolute length of the corresponding virtual displacement remains the same for all times; in other words, that the numerical values of the virtual displacements are independent of the time and depend only on the positions of the points considered. They are comparatively large at nodal lines and zero at the loops. Fig. 2 shows that high water at the ends should occur at III.36, Greenwich lunar time, and so at the middle at IX.36. Fig. 3 shows the surface of the water and the configuration of the forces at III.36 both for the nodal points and for points halfway between nodes and loops. It will be noted that the forces in the eastern half are then equal to those in the western and act in the same direction. But if the points are given a slight horizontal virtual displacement, as by putting them in positions which they occupy just previous to the time of elongation, it will be noted that for a uniform canal the displacements are equal and opposite in the two half-wave lengths. Hence, the sum of the products of the impressed periodic forces by the virtual displacements must be zero at the hour III.36.

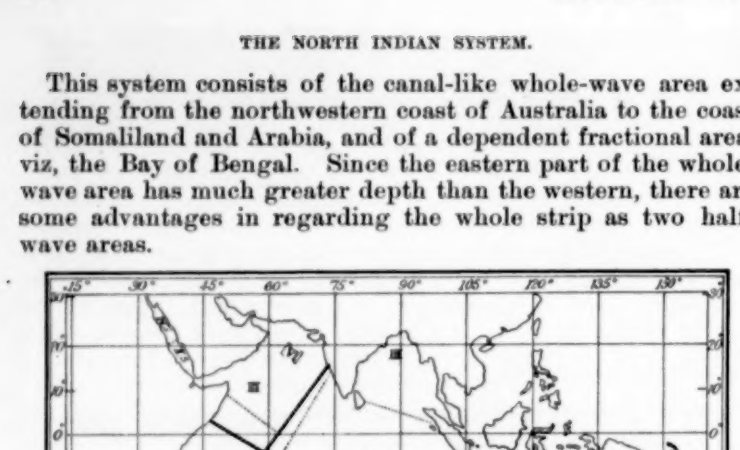


FIG. 2.

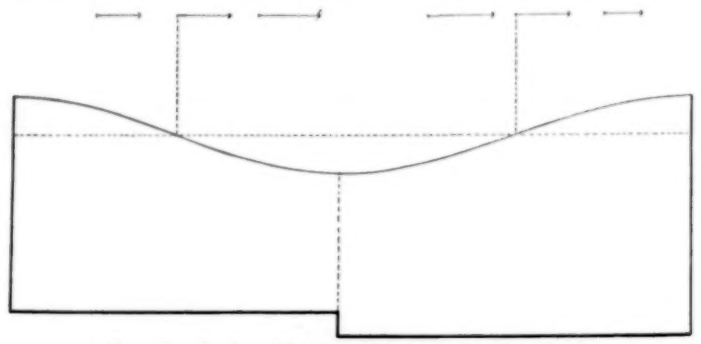


FIG. 3.—Scale of focus, 0.74 times that of fig. 2.

If two half-wave rectangular areas of different depths and widths meet end-to-end at a loop and are otherwise completely surrounded by rigid walls, the above rule for finding the time of tide by means of the virtual work can be carried out in almost as simple a manner as in the case where both are uniform; for, considering each area as being divided into the same number of elementary slices, the product mass × force × displacement in the two areas is proportional to depth × width × force. In other words, instead of giving equal weights to the two sets of values, as was done in fig. 2, one set is to be given greater weight than the other. Again, and this probably has more bearing upon the actual strip under consideration, it is reasonable to suppose that, because of the numerous straits eastward from Java, and the obliquity

[2] Appendix No. 7, United States Coast and Geodetic Survey Report for 1900, § 63.

[3] Ibid., §§ 2, 65.

of the northwestern coast of Australia to the general direction of the strip and the shoaling along this coast, a greater percentage of the forces acting upon the eastern half-wave area will be lost than of those acting upon the western. In other words, the set of values in fig. 2 belonging to the western part should have a slightly greater weight than the set belonging to the eastern. For this reason it appears that III is probably about as good a value for the times of high water of the stationary wave at the two ends as can be readily estimated from theoretical considerations.

Immediately connected with the whole-wave area is the Bay of Bengal. We can consider the water extending from the head of the bay to some distance southeast of Ceylon as a dependent area somewhat canal-like in form, with a nodal line extending from Ceylon to the western coast of Sumatra at a distance from the virtual head of the bay of $\frac{1}{4}\lambda$, or one-quarter of the wave length. This area synchronizes with the remainder of the system of which it forms a part, and the two together constitute the north Indian system.[4]

THE WATERS NORTH AND NORTHWEST OF AUSTRALIA.

The eastern half of the whole-wave area has, besides the stationary wave, whose high waters occur at III and IX, a progressive wave, due largely to straits or openings between the islands. Of special importance is the strait south of Timor Island. From this opening to the Gulf of Carpentaria, especially where the water is shallow, the tide is chiefly progressive, as shown by the cotidal lines. The progression due to this and other openings is felt half way or more to the African coast. On account of the great depth of the Banda Sea and of the shortness and considerable depths of the passages around Timor Island and vicinity, the tide is nearly simultaneous over this sea. It is somewhat later and a trifle smaller than the tide around Timor. The maximum eastward velocity through Ombay Passage north of Timor must occur between the time of mean sea level rising (for western Timor) and high water. The progressive wave due to this short strait, approaching from the west, must have its maximum velocity, or high-water phase, northwest of Timor at about the time of maximum velocity in the strait; consequently it must be in advance of what it would be were it to reach the Ombay Passage at the time of high water of the stationary wave. In other words, the tide just west or south of this boundary, pierced by short straits, is a little earlier than it would have been had the straits been broad and the area beyond shallow. It seems reasonable, therefore, to suppose that the progressive wave at the eastern extremity of the one-wave area (say about along the meridian of Kupang) should be about half an hour in advance of the stationary wave. Assuming that the amplitude of the progressive wave along the axis of the eastern part of the whole-wave area is equal to the amplitude of the stationary wave at the loops and that the former is half a lunar hour in advance of the latter at the loops, we have the distribution of the cotidal lines shown on the map along the central line of the area.

At first sight it seems strange that the amplitude of this progressive wave could be more than a small part of the amplitude of the stationary wave at the loops. But it should be noted that the energy coming through the tidal forces into the oscillating system is mainly consumed in overcoming the resistances experienced throughout its various parts. If now a part of this energy be lost to the system because of breaks in the boundary near a loop or because of extensive shoaling, the resulting progressive wave traversing a region small in comparison with the whole system may, for some considerable distance westward from the opening in the boundary, have an amplitude comparable with that of the remaining stationary wave, and the system will oscillate nearly as it would in the case where no energy were thus lost; but, of course, the amplitude will be somewhat diminished.

It is reasonable to suppose that the southern extremities of the cotidal lines west of Australia and numbered IX to II turn eastward, somewhat as shown upon the map, because of the progression directed toward Timor Island.

THE HALF-WAVE AREA.

This area extends from Mozambique Channel to Baluchistan and India, being largely a dependent one whose tide is governed by the rise and fall in and just south of the channel. It has already been remarked that observation and theory give about I.5 as the time of high water in the channel.

The bracketed values XII or 0 and VI, shown in fig. 1, are intended to refer only to the south Atlantic system; that is, they indicate the theoretical time of tide as it would be without the north and south Indian systems, and not the times of the actual tide.

Assume now the existence of the south Indian system without the north Indian; the tides in this area will, as was assumed before, synchronize with those in the channel, and so instead of 0 and VI we shall have about I.5 and VII.5.

If, on the other hand, a wall were built across the channel, the theoretical times of tide produced in this half-wave area would then be II.1 and VIII.1.

Before considering the addition of the north Indian system, we shall lay down an important but quite general lemma, and which has also a bearing upon what has just been said.

If two areas or hypothetical systems overlap sufficiently or adjoin each other sufficiently far, they will generally reduce to one system because of synchronization, provided the free period of the resulting system (as ascertained by examining the dimensions of the resulting areas and noting the depths) has not been seriously altered or is equal to the assigned period. But if the free period of the resulting system has been considerably altered from that of the original systems, the two original

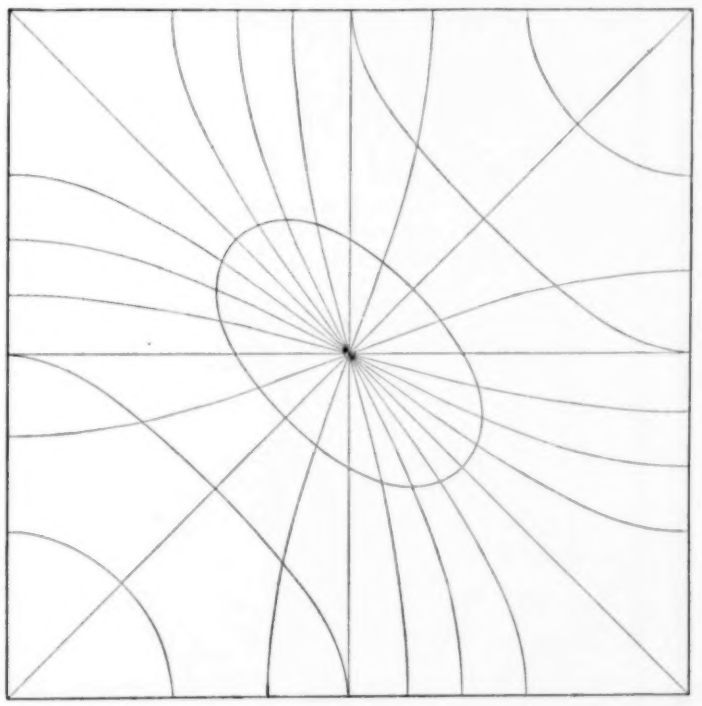


FIG. 4.

systems will not synchronize, but may oscillate nearly independently of each other. In a word, synchronization will not occur between two systems unless the constituent areas of the

[4] Cf. Appendix No. 7, United States Coast and Geodetic Survey Report, 1900, § 76.

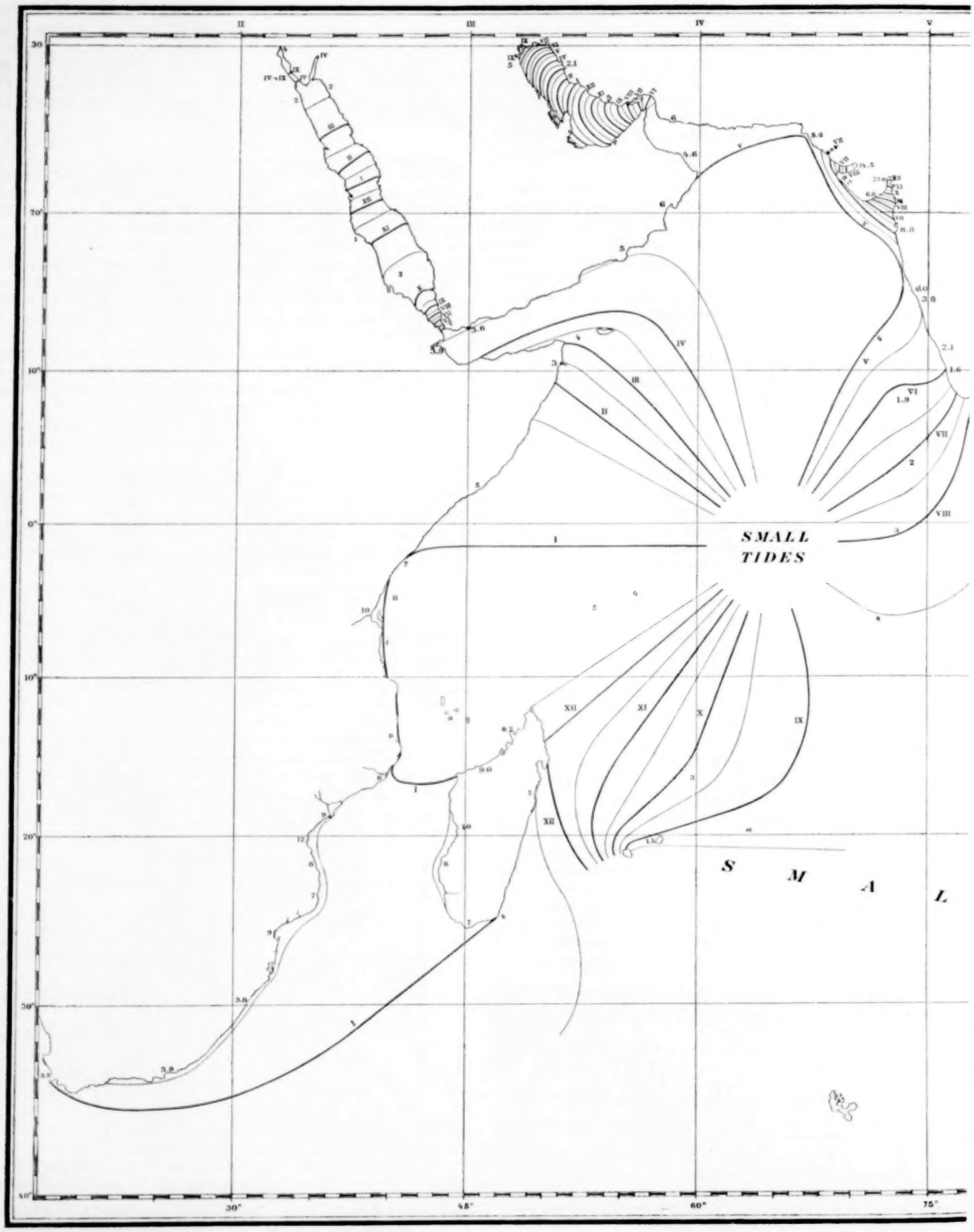
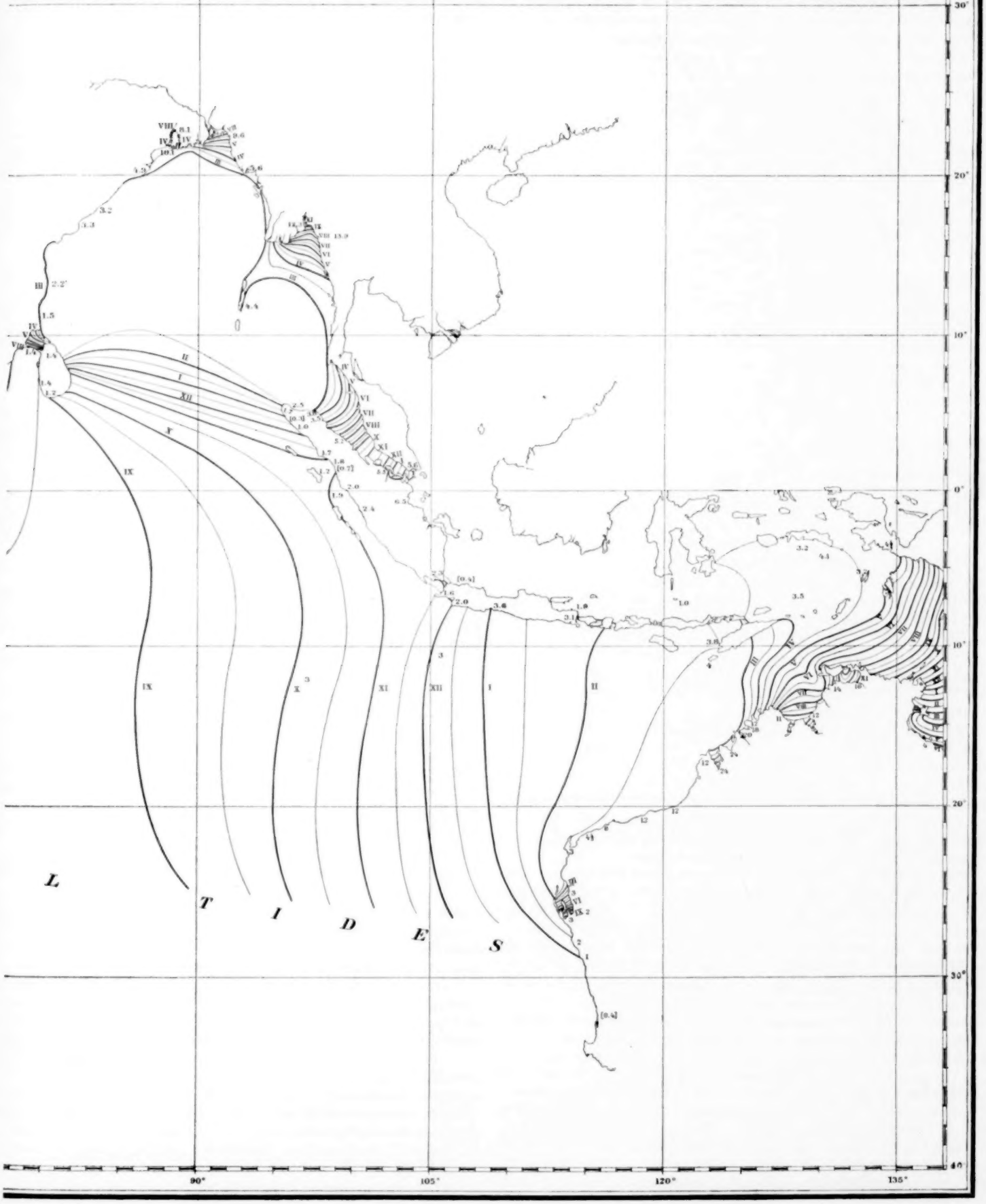


FIG. 5.—Cotidal lines for the



northern part of the Indian Ocean.

resulting systems have the given period as their own free period of oscillation.

Because of its symmetry, a square may form an exception to this rule; that is, there may be two independent oscillations at right angles to each other and differing in phase by any amount. There would then be two systems in one area.

But the L-shaped region extending from Mozambique Channel toward India, thence to northwestern Australia, can not have twelve hours as its free period because the virtual length of either of the two trapezoids into which the region can be divided is too small, being in each case less than that of the original rectangle. It is, therefore, fair to assume that the Mozambique-India half-wave area does not synchronize with the Australia-Arabia whole-wave area; for, although each has a free period approximating twelve hours, the period of the combination regarded as an L-shaped figure is much shorter.[5]

We can therefore suppose that the oscillations of the north Indian system and that of the Mozambique-India area are nearly independent of each other, although it is probable that the latter is accelerated a few minutes by the former because the loop in the Arabian Sea marked III, fig. 1, lies unequally with respect to the nodal line off Somaliland.

Before proceeding further, let us consider the case of two systems of oscillation in a square area. For simplicity, let the two amplitudes be taken as equal. Suppose the phase of the north-south oscillation to be 60° in advance of that of the east-west oscillation. Fig. 4 shows the arrangement of the resulting cotidal lines for each half hour, also the lines along which the range of the tide is constant. It is to be noted that the cotidal lines are crowded together near the nodal lines of the component oscillations. The crowding will differ from that shown in fig. 4, if we use another amplitude ratio and phase difference. But this figure will give a general idea of how the cotidal lines should be drawn for a square area. In all cases where the phase difference is not zero or 180° there must be a no-tide point around which the numbers of the cotidal lines progress, but not uniformly or at the rate due to depth. Where the phase difference is zero or 180° there will be a nodal line and no progression.[6]

Returning now to the Arabian Sea and adjacent waters we note that the conditions are far from having the simplicity of a square. Nevertheless, considering the superposition of two independent systems, it can hardly be doubted that there exists a point near the intersection of the nodal lines (fig. 1) where the range of tide is very small. It is almost certain that the cotidal lines should approximately radiate from this point being crowded together in the vicinity of Cape Guardafui and spread apart in the Arabian Sea and toward the Mozambique Channel. Moreover, the progression around this point should be clockwise and apparently irregular.

At the India end of the Mozambique-India region the east-and-west or whole-wave oscillation is probably as important as the north-and-south or half-wave: while at the south end the east-and-west oscillation is not directly felt. Hence, at India the tide occurs between the hours III and VII.5. In the Mozambique Channel, on the contrary, it occurs at I.5, or probably a little earlier (say at I), because of the slight influence of the north Indian system already referred to. Around the southern Maldive Islands, and especially around the Chagos Archipelago, the half-wave oscillation does not exist. From the Arabian Sea to the loop south of Ceylon the tide is small, and there an irregular progression occurs, as is usually the case between two nonsimultaneous regions not two far apart.[7] There is also an irregular progression from the loop south of Ceylon to northern Madagascar. The direction of these progressions is clockwise, as was that inferred at the close of the preceding paragraph. In the gulfs of Aden and Oman the tide consists chiefly of stationary oscillations, although there is some progression on account of the inner waters beyond. Each of these two gulfs constitutes a dependent canal-like area whose length is a small fraction of the wave length λ.[8]

The Persian Gulf being a large, shallow body of water connected with the Gulf of Oman by a large strait, has a tide which progresses at about the rate due to depth. There is some retardation and therefore some crowding up of the cotidal lines in the strait.

THE RED SEA.[9]

The tide in this sea is composed of a stationary wave caused by the tidal forces acting on its waters and a progressive wave produced by the outside tidal disturbances acting through the Strait of Bab el Mandeb. The force arrows applied to the nodal line of this sea regarded as a simple canal-like area whose period is about a half day, give IV.5 and X.5 as the cotidal hours of the north and south ends, respectively.

Because the range of the outside tide diminishes rapidly in passing through the strait, it is difficult to ascertain where a wave progressing at the rate due to depth will be established. But observations made at the north end of the sea indicate that high water of the resultant or combined wave occurs there at about III.75 hours, whereas according to what has just been said the high water of the stationary part should occur at IV.5. If now we assume the amplitude of the progressive wave over the Red Sea to be constantly equal to the amplitude of the stationary wave at the loops, and assume the phase of the progressive wave to be 45° in advance of the phase at the loops of the stationary wave, the result of combining the two is as shown by the cotidal lines, the extreme southern end of the sea being excepted. On account of the extreme narrowness of the strait, these assumptions concerning the progressive tide seem to be reasonable. In making the computations the depth of the sea was assumed to have a certain constant value over the region north of the nodal line and a slightly smaller but constant value over the region south of it. The manner in which the cotidal lines should be distributed in and near the strait is somewhat uncertain because the theory underlying such cases has not yet been worked out.[10]

As indicated by the map the tide in the narrow but deep Gulf of Akabah is chiefly a stationary wave, whose high water is about simultaneous with that at its mouth.

The tide in the much shallower Gulf of Tor is also chiefly a stationary wave with a node at Tor Bank.[11] However, as the ending of the gulf is not extremely abrupt there must be some small progression upward. Assuming the cotidal hour of both stationary and progressive waves to be III.75 at the mouth and the constant amplitude of the progressive wave to be one-eighth of the maximum amplitude of the stationary wave, we obtain the cotidal lines shown on the map.

NO LARGE WAVE PROGRESSES FROM THE SOUTH INDIAN OCEAN INTO THE NORTH INDIAN, PRODUCING THE TIDE OF THE LATTER.

An harmonic analysis of the tides at Freemantle, Swan River entrance, western Australia, shows that the average range of semidiurnal tide is there only 0.4 foot. A similar analysis at Port Louis, Mauritius Island, gives for the mean range of tide 1.1 feet. Again, the British Tide Tables give 3 feet as the spring range for the islands of Amsterdam and St. Paul, which is the same as the value there given for Port Louis and only a trifle greater than the value for Swan River. Hence, it is quite probable that the mean range of tide at these islands does not greatly exceed 1 foot.

Upon examining any chart of the Indian Ocean which shows the depths approximately, it will be seen, upon making a few measurements, that the region of small range extending from Freemantle to Mauritius Island can not indicate a true nodal line. Again, observations do not indicate that nearly the whole

[5] Cf. Ibid, § 42. [6] Cf. Ibid, §§ 26, 32. [7] Cf. Ibid., lemma 25, § 70. [8] Cf. Ibid., lemma 12, § 70. [9] Cf. Ibid., § 82. [10] Cf. Ibid., § 113. [11] Cf. Ibid., § 81.

of the Indian Ocean belongs to one system as such an extended nodal line would imply.

We are therefore led to believe that there is a region of small semidiurnal tides extending from Freemantle to Mauritius Island, and that the absence of a good tide is due to the fact that the distance between western Australia and Madagascar does not approximate to λ or to $\frac{1}{2}\lambda$ as an east-and-west stationary wave would require. However, on account of the progressive waves in various parts of the North Indian Ocean, there may be a small wave progression northward across the region of small tides just referred to.

There is some inward progression from Rodriguez northwesterly toward the Farquhar Islands and Cape Amber, but it is to some extent mixed up with the stationary wave around northern Madagascar. That is, it is a somewhat irregular progression. In fact the tide between Rodriguez Island and Cape Amber is due chiefly to the rise and fall at the north end of Mozambique Channel. That is, a species of dependent oscillation, part stationary and part progressive, is maintained by this rise and fall. A somewhat similar effect may exist off Northwest Cape, Australia.

MISCELLANEOUS REMARKS.

Upon referring to fig. 1 it will be noticed that because of proximity to nodal lines the range of tide around Ceylon and southern Hindustan must be small. For the same reason the tide along the outer or southwestern coast of Sumatra should be small. The tide at the western end of the southern coast of Java should be smaller than is the tide farther east. All these requirements accord well with the observed facts as can be seen upon referring to the large map, fig. 5.

The distribution of the cotidal lines through each of the nodal lines respectively located east of Ceylon, off the Malabar coast and off Somaliland, has not been made, upon the map, in accordance with any assumed mathematical law. The lines are chiefly conjectural although in accord with the observations.

Upon measuring the dimensions of the oscillating areas, it may appear that the actual lengths are a trifle too short for the existence of large tides, although no definite criterion has been laid down in such matters. There are difficulties in the application of Lagrange's rule to even a canal-like body of variable depth. It seems, however, upon comparing the times required for the eruption of Krakatoa to have been felt at ports in India, Arabia, and Africa, that the areas as laid down on fig. 1 must have a free period sufficiently long to permit good stationary oscillations.[12]

The map shows several cases in which a derived wave is produced at a sudden shoaling.[13] For example, the Gulf of Martaban, the vicinity of the mouths of the Ganges, the Gulf of Cambay, and off the Gulf of Kutch. The progression north of Australia is due largely to such sudden shoalings as the Sahul Bank. A dependent stationary wave is apparent in the Gulf of Kutch, and some traces of dependent stationary waves, shown in the acceleration of the times of the tide, can be seen at the 80-mile beach (on the northwestern coast of Australia) and near and in the mouth of the Hugli River.

Sokotra Island and neighboring shoal have some influence upon the distribution of the cotidal lines in that locality. A similar remark may be made concerning the Laccadive and Maldive islands.

In passing through Sunda Strait, the range rapidly diminishes, while the cotidal lines bunch up.[14] A somewhat similar statement is true of the narrow straits farther east.

The tide wave entering Palk Strait proceeds southwesterly up Palk Bay, at about the rate due to depth, nearly to Adams Bridge.

The tide proceeds southeasterly through Malacca Strait, but not at the rate due to depth alone, excepting in the broader portion.

EVIDENCE OBTAINED FROM TIDAL STREAMS.

The directions of the observed tidal streams as given in the Admiralty Pilots afford some clue to the character of the tidal oscillation, especially in localities where the motion is rectilinear. Around the Maldive Islands the flood stream sets easterly and around the Chagos Archipelago it sets southeasterly. In the northern end of Mozambique Channel the flood sets southerly and in the southern end northerly. Moreover, we find that flood slack occurs soon after high water in the channel, as a stationary oscillation requires. These facts could have been inferred from figs. 1 and 5.

On the southern coast of Cape Colony, from Table Bay eastward to Port Alfred, no sensible tidal stream exists although there is a moderately large rise and fall. This is in accordance with the lines of motion terminating at the shore which runs nearly perpendicular to them. See fig 1.

The southern shore of Baluchistan lies at the loop of the half-wave area as also of the whole-wave area. Consequently the tidal streams should there be weak, and observation shows this to be the case.

Across the shoals and around the islands east and northeast of Madagascar, there are strong tidal streams. According to the map of cotidal lines, this is a region where the tide varies both in time and in range; such conditions always imply large accelerating forces for the water masses and generally large velocities, especially over shoals.

In the short straits which separate from one another the islands east of Java, the currents should be swift. This statement is confirmed by observation. But whether or not the time of maximum flood velocity is an hour or so before the time of high water at the southern ends of the straits has not yet been ascertained.

Strong tidal currents occur among the Nicobar Islands and generally among the Andaman Islands. At Table Island the streams turn at about the times of high and low water.

The streams in the Gulf of Suez accord well with the notion of a stationary wave, the times of slack water very nearly coinciding with the times of the tide at the head of the gulf.

[12] Cf. The Eruption of Krakatoa and Subsequent Phenomena, tabulation opposite page 148 and Plate XXXV.

[13] Cf. Appendix No. 7, United States Coast and Geodetic Survey Report, 1900, lemma 10, § 70.

[14] Ibid, §§ 104–106.

THE ENDOWMENT OF RESEARCH IN METEOROLOGY.

[In the summer of 1902, the Chief of the Weather Bureau and other officials had occasion to present to the Carnegie Institution their views on the subject of the application of a portion of the funds of that institution to the promotion of research in meteorology. The ideas then presented were not very different from those lately defended in an interesting paper of a general character by Professor Chamberlin, the eminent geologist of the University of Chicago, who has himself published important papers bearing on the connection between the atmosphere and geology. In the belief that Professor Chamberlin's paper must contribute to promote research in meteorology and elevate the standing of our science in the colleges and universities of the country, we have requested him to present it for publication in the MONTHLY WEATHER REVIEW; in an early number we shall also submit the special reports presented to the Carnegie Institution.—ED.]

HOW CAN ENDOWMENTS MOST EFFECTIVELY AID RESEARCH?

By Prof. T. C. CHAMBERLIN, Head of the Department of Geology, University of Chicago.

I am not sure that I have rightly apprehended the special phase which it is desired the discussion should take, if, indeed, it is desired that it should take any one trend rather than another among those that are perhaps equally embraced under the broad theme announced. I have interpreted the above question as though it read, *By what assignment of endowments can research be most effectually aided?*

I assume that, with some rare exceptions, endowments may

be welcomed in whatever form they may come, but that their effectiveness may be much greater or much less according as they are judiciously or injudiciously placed. Some endowments indeed may be so hampered by restrictions that they are better declined than accepted, but these, it may be hoped, will grow more and more rare as intelligence relative to what is wise in the endowment of research increases.

I assume that the principles which control modern success in most other enterprises will be found applicable in general to the endowment of research, and that among these principles are specialization in subject, careful choice of talent, the largest possible use of the highest talent, the greatest possible avoidance of inferior talent, concentration of effort by institutions of limited means, and coordination of effort between institutions of whatever means, rising to close combination in effort whenever practicable. I assume that the discussion should take the form of concrete suggestions rather than of general principles.

1. *Endowment of chairs of research.*—The time is fully ripe for the special endowment of chairs of research. The promise of results from such endowment is very great. Not a few of the chairs in our leading universities are devoted chiefly to research, but this is usually due more to the personal force and peculiar endowments of the occupant than to self-determined provision on the part of the institution or its patrons. The chairs that are endowed primarily for research are very rare. There ought no longer to be a struggle on the part of the capable investigator to free himself from obligations to teach so that he may devote himself to creative work. It need not be urged here that creative work is more serviceable to mankind than expositional work or even disciplinary training. Real capability for investigation of a high order being granted, all pressure from the institutional environment should be such as to impel the investigator to give himself as undividedly as possible to research.

The endowment of chairs of research is here first urged not because it is superior to the modes of endowment yet to be considered, but because it requires but a moderate gift, as gifts now run, and is therefore within the reach of a large number of possible patrons, to whom endowments in more than six figures are impossible. From $100,000 to $200,000 will effectively endow a chair of research from which great results in time may be expected. Endowments of less amounts may be made to provide that a specific fraction of the time of the occupant of a chair shall be devoted to investigation, and thus creative work may be effectively promoted by a modest sum.

2. *Endowments for departmental research.*—No scientific staff of a university should regard itself as fulfilling its mission in any adequate way if it does not devote an appreciable portion of its energies to investigation. At present the provision for research is usually rather vague and uncertain, if indeed there is specific provision for it at all. While theoretically recognized as a proper function and perhaps cordially appreciated by the authorities of the institution, there is in actual practise a constant struggle between the demands of instruction and the desire for investigation, in which the preponderance of pressure growing out of the rapid growth of most universities too often lies on the instructional side. Relief for research is to be found in endowments specifically devoted to the purpose. It is here proposed that the endowment shall be made to the *department* rather than to a *specific chair*. The application of the revenue is, in this case, broader and more plastic than in the endowment of a specific chair. The function of research may be distributed among the members of the staff according to their capabilities and tastes, and thus give to them something of the touch and inspiration of creative work, while they still retain an instructional function of greater or less degree; or it may be concentrated at one time in a given line by a given member, and at another time in a different line by another member as conditions may favor. It is not in all cases, perhaps not in most cases, altogether best for the investigator to be relieved entirely from instructional function, since the exposition of his work has its good effect in forcing the organization of his thought. The critical review of it, as he assumes the obligation of presenting it to younger minds, is wholesome, as are also the questions and discussions incidental to such presentation. But the amount of such profitable instructional work has rather severe limitations. Endowments for departmental research may wisely range through the permutations of six figures into those of seven.

3. *Endowments for special research combinations.*—The early settlers of the broad fields of this country were accustomed to leave a wide, unbroken "turn-row" along their line fences, and long after the general settlement of the country these presented almost the only remaining virgin soil. It has been much the same in the pioneer cultivation of the scientific fields. Between the recognized realms of physics, chemistry, astronomy, biology, geology, and other sciences there is a border ground, which has been less cultivated than these recognized fields, and here lie the richest virgin grounds of the scientific domain. Their adequate culture requires the cooperation of men trained in the several cognate fields. A combination of men skilled in physics, astronomy, and mathematics is essential to the highest results in astrophysics. An association of men skilled in chemistry, physics, mathematics, and geology is requisite to the most promising attack upon the complicated problems of geophysics; and so of other broader grounds. There is, therefore, an eminent opportunity to promote research by endowments which shall provide for the cooperative investigation of two, three, or more men whose combined talents and training may fit them to engage jointly in a common inquiry. The endowment here must be large to be effective, but where it can be made adequate its promise of fruitage is most eminent.

4. *Endowments for schools or colleges of research.*—This is but a larger phase of endowments for departmental research, but with this difference; in the latter it is presumed that the departmental staffs of universities will continue to be, as at present, organized primarily for instructional work, while in the proposed endowment of schools or colleges of research it is presumed that research will be the dominant feature and instructional work will be incidental. Very great creative results would flow from the judicious establishment of schools of research in chemistry, physics, biology, geology, and other sciences analogous to the staffs of astronomical observatories where investigative work is now the declared purpose.

In the initial stages of the development of this scheme it is assumed that these schools of research must be individual and localized in different institutions, since no institution does now, or probably can in the immediate future, command the means for the establishment of such schools in all the departments that invite investigation. But if one institution were to concentrate upon one science or one limited group of sciences and another institution upon another science or limited group of sciences, the universities of the country might *together* cover the field effectively. It were much better, to my mind, if the aspirations of a university should take a definite specialized form of this kind in some one or some few lines, than that it should distribute its efforts over all lines with inferior success in each because of its limitation in men and means. It is probably not beyond the resources of any great university to secure the development of some one or two effective schools of research if it were content to make a selective effort and were wise enough to do this.

5. *The evolution of universities into assemblages of research schools.*—Ultimately it is to be hoped that each of the greater universities will succeed in developing a large group of research schools, and that with this there will come a gradual

reorganization of the constitution of universities, involving their transition from the function of personal education to the higher function of creative work. The English universities are now essentially an aggregate of colleges, each of which is mainly devoted to personal education. The ideal of a university, as here entertained, would make the coming university an association of colleges of research for the benefit of mankind as a whole. In the English university the several colleges cover essentially the same ground and are duplicative in their work and competitive in their relations. In the ideal university the colleges would occupy distinctive fields and be supplementary and stimulative toward each other and in no sense duplicative. Their primary function would be creative work for all mankind rather than didactic or disciplinary work for individuals.

6. *Endowments for independent institutions of research.*—The preceding discussion has related essentially to universities. Aside from organizations under governmental patronage, universities are at present the chief agencies of research. It is doubtless quite within the truth to place to their credit by far the largest amount of creative work done independently of government patronage. None the less, there is, to my view, a large and special place for independent institutions of research and endowments for such independent institutions are invited by their promise of fruitfulness. Every university has its special relations with some portion of the social organism by which it is fostered and to which, because of that fostering, it is in special bonds. While this relationship of support and consequent bondage is one of greatly preponderating good, it is not without its moiety of trammeling and limitation. In order to fill out the full complement of institutions suited to the most effective promotion of creative work, another class of institutions not subject to these relations is needed. These needed institutions might indeed likewise have their own special relationships with their own limitations and trammelings, but they should none the less fill a place not occupied by existing universities, nor likely to be occupied by them. More than this, these independent institutions of research should stand in relations of wholesome competition to the universities and by representing a different phase of endeavor should thereby contribute to the broadening of the sum total of influences at work for the promotion of research.

7. *Endowments for the higher coordination of research.*—Whatever may be the development in any of the institutions to which the phenomenal generosity of American men of means have contributed, or may yet contribute, it must still remain true that for an indefinite time the whole field of research can not be effectively cultivated by any institution, and there must be a large need for adjustment and cooperation, that the energies of research may be distributed to the greatest advantage. Even if it were possible for any institution to reasonably attempt the whole field, cooperation and coordination in research need to be cultivated to prevent wastage by unnecessary duplication and to give the greatest and best results by the adjustment of work to work. At the present stage of development provision for cooperation is eminently desirable and endowments devoted to this end give promise of being preeminently productive. The ideal scheme of coordination contemplates the correlation of talent and equipment in all the institutions devoted to research without regard to institutional relations. It should be as free as human nature permits from predilection toward one of institutional organization rather than another. It should be its function to develop, to use, and to coordinate talent, effort, and equipment wherever it may be, quite regardless of institutional connection, or locality, or of other matters than its possibilities of fruitfulness in creative work.

It need not be remarked here that we seem to be on the threshold of this great realization, and it is not too much to hope that each of the other forms of endowment will, in some large measure, appeal to the generosity and appreciation of American men of wealth.

HAWAIIAN CLIMATOLOGICAL DATA.

By CURTIS J. LYONS, Territorial Meteorologist.

OBSERVATIONS AT HONOLULU.

The station is at 21° 18′ N., 157° 50′ W. It is the Hawaiian Weather Bureau station Punahou. (See fig. 2, No. 1, in the MONTHLY WEATHER REVIEW for July, 1902, page 365.)

Hawaiian standard time is 10h 30m slow of Greenwich time. Honolulu local mean time is 10h 31m slow of Greenwich.

The pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is measured at 9 a. m. local, or 7.31 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet and the barometer 50 feet above sea level.

Meteorological Observations at Honolulu, March, 1903.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m. Greenwich time, or 1:30 a. m. Honolulu time.									Total rainfall at 9 a. m., local time.
				Temperature.		Means.		Wind.		Average cloudiness.	Sea-level pressures.		
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.		Maximum.	Minimum.	
	*	†	†			‡	‡		§				
1	30.01	66	60	73	59	52.7	63	nne.	2	4–1	30.09	29.99	0.00
2	29.99	65	60	74	61	56.5	67	ne.	2	2	30.06	29.95	0.00
3	30.00	60	59.3	73	64	58.5	73	ne.	3	5–1	30.05	29.94	0.04
4	29.99	60	59	75	59	59.3	80	ne.	2–0	5–2	30.04	29.94	0.01
5	29.99	59	57.5	76	58	59.0	76	e–se.	1–0	5–2	30.03	29.93	0.00
6	29.99	64	62.5	78	57	59.3	76	se–ne.	1–0	3–0	30.04	29.94	0.00
7	30.00	60	58	78	64	62.5	80	s–n.	1–0	3–0	30.05	29.95	0.00
8	29.98	64	61.5	78	60	59.7	79	sw–n.	1–0	1–0	30.05	29.95	0.00
9	30.01	69	63.5	78	60	61.7	77	sw.	0	1–3	30.04	29.94	0.00
10	30.08	65	57.3	76	65	60.3	72	sw–ne.	1–3	5–2	30.09	30.00	0.00
11	30.08	65	56	73	64	52.7	60	nne.	3–4	2	30.12	30.04	0.00
12	30.02	67	59.5	73	65	52.3	59	ne.	4–3	2–0	30.12	30.01	0.00
13	29.95	64	61.5	76	65	57.5	65	ne.	3	5–1	30.03	29.94	0.00
14	29.89	68	66.3	76	62	62.3	78	sw.	1–0	6–10	29.99	29.88	0.01
15	29.79	67	66.3	78	68	66.3	86	sw.	1–0	10	29.92	29.80	0.54
16	29.82	63	62	76	66	64.0	86	sw–n.	1–0	10–4	29.87	29.77	0.01
17	29.86	58	56.5	70	62	58.5	81	nw–ne.	1–0	10–8	29.93	29.85	0.00
18	29.94	59	55.5	72	57	53.7	67	nw–n.	1–3	10–1	29.95	29.87	0.02
19	29.99	64	55	73	56	53.3	67	nne.	3	3	30.02	29.92	0.00
20	29.99	61	54.5	72	63	50.0	58	nne.	3–1	5	30.04	29.95	0.00
21	29.93	57	55.7	72	58	51.5	65	nne.	3	3	30.02	29.95	0.00
22	29.82	58	57	72	56	56.3	82	sw–n.	1–0	0–8	29.95	29.81	0.00
23	29.81	65	62.5	73	57	58.5	76	sw–w.	0	10	29.88	29.78	0.00
24	29.88	62	61	74	65	61.3	80	w–sw.	0	10–5	29.89	29.81	0.00
25	29.89	58	56.5	77	61	59.3	73	w–n.	3–0	0–10	29.95	29.86	0.00
26	29.86	59	57	76	58	55.5	72	sw–w.	2–0	0–8	29.94	29.82	0.00
27	29.90	63	57.5	75	58	55.3	70	nw–w.	2	0–5	29.94	29.85	0.00
28	30.00	66	59	75	57	55.5	70	ne.	3–4	7–1	30.04	29.90	0.01
29	30.09	66	60	73	64	53.7	61	ne.	4	3–0	30.13	30.00	0.00
30	30.10	65	57.5	73	65	57.5	70	ne.	5–3	3	30.13	30.06	0.17
31	30.10	66	59.5	72	62	53.0	62	ne.	4–2	4	30.15	30.08	0.22
Sums.													1.03
Means.	29.690	63.0	59.2	74.5	61.3	57.5	72.3		1.8	4.2	30.017	29.916	
Departure.	—.047					—4.0	+0.3			—0.4			—2.73

Mean temperature for March, 1903, (6 + 2 + 9) + 3 = 67.3; normal is 70.9. Mean pressure for March, 1903, (9 + 3) + 2 = 29.970; normal is 30.017.

* This pressure is as recorded at 1 p. m., Greenwich time. † These temperatures are observed at 6 a. m., local, or 4.31 p. m., Greenwich time. ‡ These values are the means of (6 + 9 + 2 + 9) + 4. § Beaufort scale.

Maximum thermometer set at 9 p. m. and minimum at 2 p. m., local time.

Mean temperature table.

Stations.	Elevation.	Mean max.	Mean min.	Cor. av'ge.
	Feet.	°	°	°
Pepeekeo	100	73.1	64.8	68.2
Waimea	2,730	70.5	54.2	61.6
Kohala	521	74.3	62.6	67.7
Nahiku	1,600			
Waiakoa	2,700	71.3	51.7	60.8
Ewa Mill	50			
United States Magnetic Station	50	78.2	59.0	67.9
United States Experimental Station	350	75.8	63.0	68.7
W. R. Castle	60	78.0	55.0	67.2
Tantalus	1,725			
Hilo	40	77.2	64.0	69.9
Waikiki	15	75.2	62.6	68.2

Rainfall data for March, 1903.

Stations.	Elevation.	Amount.
HAWAII.		
HILO, e. and ne.	*Feet.*	*Inches.*
Waiakea	50	3.55
Hilo (town)	100	.....
Kaumana	1,250	6.49
Pepeekeo	100	7.71
Hakalau	200	.....
Honohina	300	.....
Puuohua	1,050	15.93
Laupahoehoe	500	10.81
Ookala	400	8.37
HAMAKUA, ne.		
Kukaiau	250	11.60
Paauilo	300	9.31
Paauhau	300	9.05
Honokaa (Mill)	425	9.42
Honokaa (Meinicke)	1,100	.....
Kukuihaele	700	8.70
KOHALA, n.		
Awini Ranch	1,100	11.17
Niulii	200	4.61
Kohala (Mission)	521	5.21
Kohala (Sugar Co.)	270	3.66
Hawi, Mill	700	4.70
Puakea Ranch	600	2.98
Puuhue Ranch	1,847	2.78
Waimea	2,720	2.91
KONA, w.		
Holualoa	1,350	2.95
Kealakekua	1,580	4.13
Napoopoo	25	0.56
Hoopuloa	1,650	2.54
KAU, se.		
Kahuku Ranch	1,680	.....
Honuapo	15	4.23
Naalehu	650	4.42
Hilea	310	6.00
Pahala	850	.....
Moaula	.....	.....
Volcano House	4,000	6.14
PUNA, e.		
Olaa, Mountain View (Russel)	1,690	6.17
Kapoho	110	7.78
Pahoa	600	8.72
MAUI.		
Lahaina	40	.....
Waiopae Ranch	700	3.05
Kaupo (Mokulau), s	285	2.45
Kipahulu, s	308	.....
Nahiku, ne	800	10.20
Nahiku	1,600	.....
Haiku, n	700	4.50
Kula (Erehwon), n	4,500	2.08
Kula (Waiakoa), n	2,700	1.45
Puuomalei, n	1,400	4.61
Paia	180	2.92
Haleakala Ranch	2,000	3.59
Wailuku, ne	250	1.69
OAHU.	*Feet.*	*Inches.*
Punahou (W. B.), sw	47	1.03
Kulaokahua (Castle), sw	50	0.38
Makiki Reservoir	120	0.44
U. S. Naval Station, sw	6	0.44
Kapiolani Park, sw	10	0.35
College Hills	175	0.98
Manoa (Woodlawn Dairy), e	285	1.54
Manoa (Rhodes Gardens)	360	2.73
School street (Bishop), sw	.....	.....
Insane Asylum, sw	30	0.64
Kamehameha School	75	.....
Kalihi-Uka, sw	485	2.43
Nuuanu (W. W. Hall), sw	50	0.67
Nuuanu (Wyllie street)	250	0.81
Nuuanu (Elec. Station), sw	405	0.87
Nuuanu (Luakaha), e	850	2.55
U. S. Experiment Station	350	0.60
Laniakea (Nahuina)	1,150	0.95
Tantalus Heights	1,360	2.05
Waimanalo, ne	300	0.80
Maunawili, ne	300	1.95
Kaneohe	100	1.55
Ahuimanu, ne	350	2.87
Kahuku, n	25	1.13
Waialua	37	0.98
Wahiawa	900	0.74
Ewa Plantation, a	60	0.51
U. S. Magnetic Station	45	0.34
Waipahu	200	.....
Moanalua	15	0.60
KAUAI.		
Lihue (Grove Farm), e	200	2.02
Lihue (Molokoa), e	300	1.65
Lihue (Kukaua), e	1,000	1.68
Kealia, e	15	0.38
Kilauea, ne	325	1.66
Hanalei, n	10	2.52
Waioli	10	1.64
Haena	15	2.63
Waiawa	32	0.62
Eleele	150	.....
Wahiawa (Mountain)	3,000	1.40
McBryde (Residence)	850	1.26
Lawai (Gov. Road)	450	1.24
Lawai, w	225	1.68
Lawai, e	800	1.20
Koloa	100	2.06
Delayed February reports.		
Hoopuloa	.....	1.80
Pahala	.....	2.64
Moaula	.....	3.83
Puuomalei	.....	10.58
Wyllie Street	.....	5.87

NOTE.—The letters n, s, e, w, and c show the exposure of the station relative to the winds.

GENERAL SUMMARY FOR MARCH, 1903.

Honolulu.—Temperature mean for the month, 67.3°; normal, 70.9°; average daily maximum, 74.5°; average daily minimum, 61.3°; mean daily range, 13.2°; greatest daily range, 21.0°; highest temperature, 78°; lowest, 56°.

Barometer average, 29.970; normal, 30.017; highest, 30.17, 31st; lowest, 29.77, 15th; greatest 24-hour change, that is, from any given hour on one day to the same hour on the next, 0.17; lows passed this point on the 15th and 22d; highs on the 10th and 31st.

Relative humidity average, 72.3 per cent; normal, 72.0 per cent; mean dew-point, 57.5°; normal, 61.5°; mean absolute moisture, 5.32 grains per cubic foot; normal, 6.05 grains; dew on grass, 17 mornings.

Rainfall, 1.03 inches; normal, 3.76; rain record days, 9; normal, 18; greatest rainfall in one day, 0.54, on the 15th; total at Luakaha, 2.55; normal, 14.26; at Kapiolani Park, 0.35; normal, 3.19.

The artesian well water fell during the month from 35.25 to 34.85 feet above mean sea level. March 31, 1902, it stood at 34.05. The average daily mean sea level for the month was 9.59, the assumed annual mean being 10.00 feet above datum. For March, 1902, it was 9.85.

Trade wind days, 15, (4 NNE.); normal, 18; average force of wind during daylight, 1.8, Beaufort scale. Average cloudiness, tenths of sky, 4.2; normal, 4.6.

Approximate percentages of district rainfall as compared with normal: South Hilo, 25; North Hilo, 62; Hamakua, 100; Kohala, 80; Waimea, 57; Kona, 130; Kau, 95; Puna, 90; Maui, 60; Oahu, 20; Kauai, 30.

Kohala dew point average, 59.3°; relative humidity, 75 per cent; Magnetic Station, 58° and 70 per cent.

The month has been on the whole a remarkable one, being marked by low barometer, low dew-point, and low temperature, being as cold as February which was the coldest month on record for twenty-five years. Also by unusually light winds for March, and with the exception of March, 1889, the lightest rainfall on record for the station.

Moderately heavy surf, 7th, 18th, and 31st. Lightning, none. Earthquakes, Hilo, 13th, 6 p. m., 23d, 11:25 p. m.; Waimea, 13th, 6:15 p. m.; Kohala, 15th, 6:15 a. m. Snow very much diminished on Mauna Kea and Mauna Loa. Solar haze.

MARCH WINDS.

By R. C. WEBBER, Acting Director Meteorological Service of Canada, dated Toronto, April 20, 1903.

As the impression appears to be somewhat general in Canada that March is a month of excessive wind mileage and at the same time of very cold winds, a review of what has actually occurred during the past thirty years in regard to these matters in Ontario, Quebec, and the Maritime Provinces will perhaps be of some interest. Thirty years is not a very long period, but is probably of sufficient length to give approximately the prevailing characteristics of the month.

From March, 1874, to 1903, both inclusive, we find that the number of gales[1] occurring in Ontario was 48 less than in the corresponding series for December, 38 less than in January, and 25 less than in February. In the Province of Quebec the numbers for the same period were 48, 56, and 28, and in the Maritime Provinces 37, 69, and 27.

As gales, as a rule, continue for at least one and not infrequently for two or more days, the large diminution of the number of gales in March must necessarily mean a considerable decrease in the number of days with high winds compared with the number of days of high winds occurring during the three preceding months. It might here be noted that the much smaller number of gales in February than in January is in part accounted for by the lesser number of days in February, taken, of course, in conjunction with the gradual decrease of stormy weather as the season advances toward spring. It may be suggested that when a high wind sets in in March it is likely to continue longer than at any other season of the year, but there is nothing in the general movements of high and low pressure areas to warrant such a supposition. As to the winds being of excessive coldness, temperature records for a long series of years prove March in Ontario to be from 6° to 10° warmer on the average than in February. In Quebec March is 9° warmer and in the Maritime Provinces 7° warmer than in February. Such a large difference in the average mean temperature between the two months must give fewer cold winds in March than in February. We also find, on comparing records again, that the snowfall of March is very much less than during the preceding winter months.

We are all familiar with the old English saw, "If March comes in like a lion it goes out like a lamb," or vice versa. This saying has been apparently somewhat perverted, for a reference to an old book styled "Weather Folk-lore" quotes the following: "March comes in like a lion and goes out like a lamb." "March comes in with an adder's head, but goes out like a peacock's tail." Turning again to the records of the past thirty years we see that in Ontario March went out rough

[1] Presumably the author means days with gales.—C. A.

on nineteen years, in Quebec on eighteen, and in the Maritime Provinces on seventeen years; consequently, March appears to be more likely to go out like a lion than a lamb. As to the idea that if March comes in rough it will go out quietly, or vice versa, there is nothing in the records to justify this assumption, for during the past thirty years these conditions were maintained in twelve years only, in Ontario and Quebec, and in eleven in the Maritime Provinces. With such a long series of records opposed to the generally conceived notions of the dreaded conditions to be anticipated in March, it must be allowed that the supposed eccentricities of the weather of the month are largely illusory.

Many of the old sayings and proverbs regarding the weather and its changes have been handed down in Canada from generation of descendants chiefly from the British Isles, and these legends if applicable to the weather conditions of those Islands, which is very doubtful, are not so to a continental climate such as we enjoy.

Ontario, Quebec, and the Maritime Provinces have only been treated of in this paper because similar records of the winds, etc., are not available for the remaining parts of Canada, however, there can be no apparent reason why the same sequence of changes experienced over the districts reviewed should not occur elsewhere in the Dominion and in fact throughout the northern temperate zone generally; i. e., a marked decrease in stormy weather as the season advances toward the spring and summer.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physical Geographic Institute.
[For tables see the last page of this REVIEW preceding the charts.]

Notes on the weather.—On the Pacific slope the drought was excessive and continuous, but for a few light squalls of rain during the 27th, 28th, and 29th. In San José the pressure was slightly above the normal, while the heat and relative humidity were less. The sunshine records show an excess of about thirty-two hours above the general mean. On the Atlantic slope the rainfall was almost everywhere in excess of previous years, except on the coast belt where the drought was rather marked, and provoked, in Port Limon and its surroundings, a spell of bad fevers and general diseases.

Notes on earthquakes.—March 2, $6^h\ 47^m$ p. m., slight shock NW-SE, intensity I, duration 3 seconds. March 12, $2^h\ 25^m$ a. m., pretty generally felt shock N-S, intensity II, duration 4 seconds. March 21, $4^h\ 40^m$ a. m., prolonged vibration E-W, intensity II, duration 15 seconds. March 30, $5^h\ 33^m$ a. m., long oscillatory movement WNW-ESE, intensity III, duration 30 seconds. The same earthquake was officially reported from Cachi and San Isidro de Alajuela and was generally felt all through the interior of the country.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——.

Science. London. N. S. Vol. 17.

Bolton, Henry Carrington. Origin of the word "Barometer." Pp. 547–548.

Ward, R. DeC. Bigelow's Barometry. [Note on report by F. H. Bigelow.] Pp. 595–596.

Ward, R. DeC. Meteorological Observations in Bosnia. [Note on article by Hann.] P. 596.

Ward, R. DeC. High Winds on the Pacific Coast. [Note on article in Annual Report of the California Climate and Crops.] P. 596.

Scientific American. New York. Vol. 88.

Crookes, William. Sir William Crookes on Radium. P. 311.

Scientific American Supplement. New York. Vol. 55.

—— The New Observation Kites invented by S. F. Cody. P. 22804.

—— Kites as Meteorological Instruments. P. 22823.

Proceedings of the Royal Society. London. Vol. 49.

Lockyer, Norman and Lockyer, William J. S. Relation between Solar Prominences and Terrestrial Magnetism. Pp. 244–250.

Russell, W. J. On the formation of Definite Figures by the Deposition of Dust. Pp. 285–287.

Aeronautical Journal. London. Vol. 7.

Anderson, John. The Kite Equipment of the Scottish National Antarctic Expedition. Pp. 25–28.

Alexander, Patrick Y. The Aërosac. P. 28.

Blackden, L. S. Observations and Experiments relative to Equilibrium in Air of a Body Heavier than Air. Pp. 28–40.

Symons's Meteorological Magazine. London. Vol. 38.

—— Great Dustfall of February, 1903. Pp. 21–24.

Stupart, R. F. Canadian Climate. Pp. 31–33.

American Journal of Science. New Haven. 4th series. Vol. 15.

Trowbridge, J. Gaseous Constitution of the H and K lines of the Solar Spectrum, together with a discussion of reversed gaseous lines. Pp. 243–248.

Physical Review. Lancaster. Vol. 16.

Barus, C. The Nucleation during Cold Weather. Pp. 193–198.

Scottish Geographical Magazine. Edinburg. Vol. 19.

Mossman, R. C. Meteorological Notes. Pp. 180–183.

Nature. London. Vol. 67.

Rosse, Lord. Effects of the Gale of February 26. P. 462.

Windsor, E. V. Hygrometric Determinations. Pp. 463–464.

Harding, Chas. Remarkable Winters. Pp. 466–467.

S., F. J. J. Movement of Air studied by Chronophotography. Pp. 487–488.

—— Accumulation of Meteorological Observations. Pp. 497–498.

—— Lodge, Oliver. Radium Emission. P. 511.

Rutherford, E. Radio-Activity of Ordinary Materials. Pp. 511–512.

Crookes, William. Emanations of Radium. Pp. 522–524.

Milne, J. Seismometry and Gëite. Pp. 538–539.

—— Variation of Solar Radiation received on the Earth's Surface. [Note on article by Henri Dufour.] P. 545.

Russell, W. J. Formation of Definite Figures by the Deposition of Dust. Pp. 545–546.

—— London Fog Inquiry, 1901–02. Pp. 548–549.

Comptes Rendus de l'Académie des Sciences. Paris. Tome 136.

Curie, P. and Laborde, A. Sur la chaleur dégagée spontanément par les sels de radium. Pp, 673–675.

Chauveau, A. B. Sur les poussières éoliennes du 22 février. Pp. 776–777.

Mascart, E. Remarques sur la note précédente. Pp. 777–778.

Pellat, H. De la température absolue déduite du thermomètre normal. Pp. 809–811.

Fonvielle, W. de. Hypothèse de J. B. Biot pour expliquer la hauteur de l'atmosphère. P. 835–837.

Ciel et Terre. Bruxelles. 24me année.

Prinz, W. Analyse de la boue tombée en Belgique le 22 février 1903. Pp. 25–31.

L., V. D. Les vents dominants indiqués par les arbres. [Note on article by J. Früh.] P. 41–42.

Van der Linden, E. La pluie de poussière des 21 et 22 février 1903. Pp. 49–55.

Chauveau, A. B. Historique des théories relatives à l'origine de l'électricité atmosphérique. Pp. 59–70.

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Maillet, Edmond. Résumé des observations centralisées par le Service Hydrométrique du bassin de la Seine, pendant l'année 1901. Pp. 21–28.

Besson, Louis. Un nouveau néphoscope. Pp. 29–31.

Raulin, V. M. Sur les observations pluviométriques faites dans l'Asie centrale Russe. Pp. 37–42.

La Géographie. Paris. Vol. 7.

Bénard, Charles. Les courants de l'Atlantique Nord et du golfe de Gascogne. Pp. 1–18.

Journal de Physique. Paris. 4me séries. Tome 2.

Mathias, E. Théorie des phénomènes critiques et la vaporisation. Contribution à la théorie des dissolutions. [Note on article by J. Traube.] Pp. 206–211.

Annalen der Physik. Leipzig. Vierte Folge. Band 10.

Toepler, Max. Ueber Funkenlängen und Anfangsspannungen in Luft von Atmosphärendruck. Pp. 730–747.

Olszewski, K. Apparate zur Verflüssigung von Luft und Wasserstoff. Pp. 768–782.
Richarz, F. Temperatur differenzen in künstlich erzeugten auf und absteigenden Luftströmen nach Messungen von Hrn. S. Löwenherz. Pp. 863–879.
Gaea. Leipzig. 39 Jahrg.
—— Ueber Methoden der Forschung in der Meteorologie. Pp. 279–285.
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Das Wetter. Berlin. 20 Jahrgang.
—— Erklärung der in den Witterungsberichten und Witterungsaussichten der Seewarte angewandten Ausdrücke. Pp. 49–56.
Frenbe, —. Ein landwirtschaftlicher Wetterdienst. Pp. 56–63.
Meinardus, W. Zur Erläuterung. P. 65.
Geographische Zeitschrift. Leipzig. 9 Jahrgang.
Maurer, Hans. Eine klimatologische Studie. Pp. 80–90; 140–149.
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Wojeikow, A. J. Der jährliche Wärmeaustausch in den nordeuropäischen Seen. Pp. 193–199.
Crugnola, Gaetano. Zur Dynamik des Flussbetts. Pp. 241–251.
Illustrirte Aeronautische Mittheilungen. Strassburg. 7 Jahrgang.
Moedebeck, H. W. L. Die Luftschiffahrt in Japan. Pp. 101–108.
Stauber, —. Eine Hochfahrt des Wiener Aëro-Clubs. Pp. 109–116.
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Woeikof, A. Probleme des Wärmehaushaltes des Erdballs. Pp. 49–54.
Woeikof, A. Die Resultate der Karaboghaz-Expedition. Pp. 54–57.
Woeikof, A. Die Isothermen im westlichen tropischen Südamerika. Pp. 57–58.
Hegyfoky, J. Die Frühlingsankunft der Wandervögel und die Witterung in Ungarn. Pp. 58–64.
Grimaldi, G. T. Der Wolkenbruch vom September 1902 in Sizilien und die Ueberschwemmung von Modica. Pp. 64–67.
—— Elektrische Erscheinungen beim Ausbruch des Soufrière auf S. Vincent am 3 und 4 September 1902. Pp. 67–68.
—— Resultate der Beobachtungen auf dem Kodaikanal-Observatorium in Südindien im Jahre 1901. P. 68–69.
Hann, J. Vierzigjährige Temperaturmittel für Malta. Pp. 69–71.
Hann, J. Zum Klima von Malta. Pp. 71–75.
Hann, J. Zur Meteorologie des Innern von Südafrika. Pp. 75–79.
Ernst, M. Selbstleuchtende Wolken. Pp. 79–80.
Hergesell, —. Vorläufiger Bericht über die internationale Ballonfahrt vom 2 Oktober 1902. Pp. 80–81.
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Hergesell, —. Vorläufiger Bericht über die internationale Ballonfahrt vom 4 Dezember 1902. Pp. 82–83.
—— Wärme und Höhenrauch im Februar. P. 83.
—— Staubregen. P. 83–84.
Trabert, W. NW-Föhn in Innsbruck. P. 84–85.
Kassner, C. Die Niederschläge zu Belgrad (Serbien). Pp. 85–87.
MacDowall, Alex. B. Der Regenfall im Frühjahr und Herbst. P. 87.
—— Nordlichtbeobachtungen. Pp. 87–88.
MacDowall, Alex. B. Retardation von Perioden. P. 88.
Lockyer, N. and Lockyer, W. J. S. Ueber die Aehnlichkeit kurzperiodischer Luftdurckänderungen über grossen Gebieten. Pp. 88–90.
Wilson, Alfred W. G. Aussergewöhnlicher Hagelfall. Pp. 90–91.
Messerschmitt, J. B. Ueber das Erdbeben vom 26 November 1902. Pp. 91–92.
Fischer, L. Orkan bei Barzdorf. P. 92.
Ischirkoff, A. Zum Klima von Sofia. I. Einige Notizen über die Lufttemperatur von Sofia. Pp. 97–100.
Kassner, C. II. Ueber den täglichen Gang der Temperatur zu Sofia. Pp. 100–103.
Ischirkoff, A. and Kassner, C. III. 10 jährige Mittel von Sofia. Pp. 103–107.
Ebert, Hermann. Die atmosphärische Elektrizität auf Grund der Elektronentheorie. Pp. 107–114.
Martin, C. Zum Klima von Südchile, Llanquihue und Chiloé. Pp. 114–122.
Hann, J. Die Zusammensetzung der Atmosphäre. P. 122–126.
Prohaska, K. Hagelfälle im Sommer 1902 in Steiermark. Pp. 126–130.
Woeikoff, A. Frühling nach sehr warmem Februar. P. 130.
—— Staubfall am 22 Februar. P. 131.
—— Staubfall in England. P. 131.
—— Höhenrauch und Staubregen am 21 und 22 Februar 1903. Pp. 131–133.
H[ann], J[ulius]. Ueber die Ursache des Staubfalles vom 21 und 22 Februar. P. 133.
Hellmann, G. Die Staubfall vom 21 bis 23 Februar 1903. Pp. 133–135.
Egnell, A. Die Aenderung der Windgeschwindigkeit mit der Höhe. Pp. 135–137.
Kesslitz, W. Resultate der meteorologischen Beobachtungen zu Pola 1867–1900. Pp. 137–141.
H[ann], J[ulius]. Klima von Hebron. Pp. 141–142.
Hemel en Dampkring. Amsterdam. April 1903.
Mars, S. Methoden van onderzoek in de meteorologie. Pp. 115–118.
Monné, A. J. Vermoedelijke oorzaak der fouten bij de aflezingen van minimum-temperaturen der lucht. Pp. 107–114.

NOTES AND EXTRACTS.

SECOND RUSSIAN CONGRESS ON CLIMATOLOGY.

A letter from General Rykatcheff, director of the Nicolas Central Physical Observatory at St. Petersburg, announces that the second Russian congress on climatology, hydrology, and balnealogy, in commemoration of Peter the Great, will meet this year, from September 14 to 20 (new style), at Piatigorsk (German, Pjatigorsk). This place is north of the Caucasus Mountains and about 1400 meters or about 4500 feet above sea level; it is a little to the south of the main line of railroad leading to the Russian port of Petrovsk, on the Caspian Sea, and is about 90 kilometers northwest from the summit of Elbrus, whose altitude is 5631 meters, or over 18,000 feet, and whose snow-clad summit can ordinarily be seen. Its latitude is 44° north, longitude 43° 30′ east. General Rykatcheff gives the following interesting information:

One section of this congress will be devoted to climatology. The program for this section will consist of the following questions:

1. Comparison of the climates of different Russian climatological stations with those of corresponding stations in foreign countries.
2. Climates of mountains.
3. Influence of forests on climate.
4. Changes of climate caused by the works of man.
5. Comparison of the climate of a city with that of its suburbs.
6. Determination of the quantity of dust and of the number of microbes in the air of different localities and at different altitudes.
7. Isolation at different altitudes.
8. Organization of meteorological stations at watering places and climatic stations.

Various questions relative to climato-therapy will also be discussed.

It is desired to make the members of the congress acquainted with the works of Russian and also of foreign scientists relative to these questions. I therefore take the liberty of requesting you to communicate with the managers of watering places and climatic stations in your country and to suggest to them that they send descriptions of the places under their management and the works of climatology relative thereto. These publications will have a particular interest to members of the congress in view of the fact that watering places are much frequented by our countrymen. If any person should desire to present a note relative to questions on the program, in French, German, or English, it will be gratefully received.

You are requested to address letters and publications to the Nicolas Central Physical Observatory at St. Petersburg, "for the Congress of Climatology."

WEATHER CYCLES AND FARMERS' ALMANACS.

A correspondent writes from Ruxton, Md., as follows:

The fact has come under my observation that a great many, especially among farmers and country people, place a good deal of confidence in the predictions of these so-called "weather prophets," whose vivid imaginations are portrayed in the pages of nearly all cheap almanacs.

It is true that a few prognosticators appear to base their forecasts on astronomical phenomena. If there is any question at all as to whether their researches might be an aid to the science of meteorology, it would not seem best to interfere.

It does not seem right, however, that these "weather prophets" should be allowed to publish such worthless predictions, which are not only in direct opposition to the work of the Weather Bureau, but by their widespread circulation through the country prove an actual injury to the less intelligent masses of our population. They are harmful to the farmer, because he depends in his business on weather forecasts which only by mere chance may come true, while the people in general are kept in ignorance and superstition, contrary to the advancement of an enlightened age.

In the vicinity of a large city, where the daily newspapers and fore-

casts of the Weather Bureau are more commonly seen, there is less reference made to the almanac, but it is certainly true that among the more remote districts (though by no means confined to them) these useless pages are continually referred to and depended upon. Unfortunately, the people seem to be more impressed with the occurrences when the forecasts come true than they are with the many cases of failure. As a result there is a continual faith and dependence placed in predictions which are commonly founded on no more scientific basis than the imaginative powers of the "prophet."

I feel sure that any action taken to prevent such enterprises will prove an important aid in effecting a still greater scope and efficiency in the work of the Weather Bureau.

We are encouraged to believe that the weather forecasts of the ordinary farmers' almanacs are not greatly relied upon, and that those who have considerable moneyed interests at stake are daily guided in their transactions by the published forecasts of the Weather Bureau. At least this is what we must infer from the numerous expressions of satisfaction that are received whenever any great atmospheric crisis passes by. Although in the majority of cases the predictions of the almanacs do not command entire confidence, yet, as our correspondent states, the mere fact that they are regarded with interest, lenience, and even respect by so many persons suffices to show how little the spirit of modern meteorology has as yet replaced the ancient belief in long-range weather forecasts. Perpetual motion, squaring the circle, transmutation of metals, and many other errors are banished from men's minds, but planetary influences, fortune telling, and lotteries still have their devotees.

We fully recognize the value of the work of those long-range forecasters who are comparing early weather records with those of the present day and are searching for cycles, chronological periods, or geographical relations, by means of which the weather at distant places or distant times may possibly be foreseen. They have a tedious work before them and will, we fear, reap very unsatisfactory results. We would not deter any honest investigation of this empirical sort by students who have neither taste nor ability for any other work, for it certainly is possible that we may be mistaken in our forebodings, and that good results may flow from their researches. But we think that there are much brighter prospects for those who are able to attack the problems of meteorology with the weapons that have been fashioned by skillful mathematicians and mechanicians.

The brilliant success of Schwabe, who observed the sun spots year after year until, he was able in 1851 to announce that there was a periodicity in their frequency, followed, as it very soon was, by the discovery of a parallel period in the disturbances of the magnetic needle or, what is the same thing, in the earth's magnetic field, has led numerous students to search for similar parallel periods in various meteorological phenomena, although no one knows why the spottedness of the sun should thus affect the earth's atmosphere. Of course, the hypothesis that it does so, may be accepted as a working hypothesis and may serve to keep meteorologists on the qui vive, but we think it necessary to caution our readers against spending much time in search of sun-spot weather periods. They have thus far proven very elusive.

In a famous article on the meteorology of the future, by J. Norman Lockyer, published in the seventh volume of Nature, that distinguished author says:

> Surely in meteorology, as in astronomy, the thing to hunt down is a cycle * * * and if found, then, * * * lay hold of it, study it, record it, and see what it means. If there is no cycle, then, despair for a time, if you will, but yet plant firmly your science on a physical basis, and having got such a basis as this wait for results. * * * I said "the thing to hunt down is a cycle." Now, it may be asked, is there anywhere on earth a weather cycle? But anyone who asks this question will at once answer it himself; the question would certainly suggest the trade winds and monsoons, which are short period cycles. But is there anything more than this?

Following the above quotation, Mr. Lockyer (now Sir Norman Lockyer) gave some interesting details with regard to the history of the discovery of an 11-year period in the Ceylon rainfall and of Meldrum's 11-year periodicity of cyclones and rainfall in the Indian Ocean, Cape Colony, and Australia. After stating the analogy between the sun-spot periods in meteorology and the Saros period of the ancient astronomers, he said:

> As the astronomers of old were profoundly ignorant of the true cause of the Saros period, so the meteorologists of the present day are profoundly ignorant of the true nature of the connection between the sun and the earth. What, therefore, is necessary in order to discover the true nature of this nexus? Two things are necessary, and they are these: In the first place, we must obtain an accurate knowledge of the currents of the sun, and secondly, we must obtain an accurate knowledge of the currents of the earth. The former of these demands the united efforts of photography and spectrumanalysis, and the second of these demands the pursuit of meteorology as a physical science and *not* as a mere collection of weather statistics.

The above article appearing in Nature for December, 1872, has been followed by a long series of investigations in solar physics, in meteorology and in the relation between these two. On reviewing the work of this third of a century, we are impressed with the conviction that although we now know more about the sun and our atmosphere, yet we do not know much more about the connection between the two. It seems to me unlikely that we shall ever find any simple cycles in atmospheric phenomena or any simple relations between solar and atmospheric phenomena. So far as concerns pressure and wind, temperature and rainfall, I think that if the sun's radiation were absolutely uniform as to quality and quantity, there would still result the ordinary areas of high and low pressure, the winds, and other phenomena about as we now have them. The rapid rotation of the earth combined with the mountains and other irregularities on its surface, must produce most of the highs and lows and both the steady and variable winds. The continents, oceans, and aqueous vapor, introduce the most important irregularities into the motions of the atmosphere. If there are any variations in the quantity and quality of solar radiation that produce appreciable effects in our atmosphere, they are so slight as to be only demonstrable after the most laborious investigation; so far as I can see these variations have not as yet been shown to have any meteorological importance. They may be curious and interesting; they may be important with regard to solar physics, but they do not constitute an important chapter in dynamic meteorology and the whole subject is very properly dismissed in a page or two of Professor Hann's recent treatise on meteorology. The conservative article by Mr. C. G. Abbot in the MONTHLY WEATHER REVIEW for April, 1902, fully confirms the above conclusion. Of course, it is quite possible that great variations in the solar radiation may have taken place in past ages and produced great changes in climates at those times, but at the present time, and since the days of Galileo, meteorologists must treat the solar radiation as uniform and must study the mechanics of an atmosphere on a rough round surface under a uniform solar radiation. It is only after we have solved the mathematical difficulties involved in this latter problem that we shall be prepared to study with success the influence of the variations of the solar radiation.

It is all well enough for those whose tastes incline toward experimental physics to investigate the peculiarities of the solar radiation with the spectroscope, bolograph, and other modern physical apparatus, but the meteorologist must study the far more difficult fundamental mechanical problems that still await solution at the hands of the mathematicians. It can easily be shown that the interaction of atmosphere and earth must produce numerous quasi-periodic phenomena, which die out after a few repetitions, only to be started up again when favorable conditions subsequently occur. These periods are

mechanically analogous to the whirls that may be seen floating down stream in any deep and rapid river or to the standing waves behind the stones in a shallow river or to the spots of steady and unsteady flow of water through a long tube. All these periodicities originate within the atmosphere and are due to its internal mechanical conditions, not to the influence of external conditions, such as periodicity in solar radiation.

All the measurements made with the pyrheliometer or actinometer during a century past unite in showing appreciable variations in the quantity of heat received from the sun. But in no case have we been able to show that the variations take place at the sun itself. On the contrary, they have most plausibly been traceable back to variations in the gases, moisture, and dust of our own atmosphere. If there are general variations in the temperature or rainfall or pressure on different portions of the earth's surface, we must attribute these to what is going on on the earth's surface, not on the sun's surface. During the interval between August, 1902, and March, 1903, reports have come from several portions of the world indicating peculiar local conditions; thus, for instance, both Henri Dufour, in Switzerland, and H. H. Kimball, at Asheville, N. C., report an apparent diminution in the solar radiation as measured by the best actinometers. This may easily be accounted for by the presence of an extra quantity of moisture or haze or even volcanic gases in the atmosphere above their stations. Such changes in the atmospheric constituents may be due to changes in the general circulation of the atmosphere in the respective portions of the globe. But the latter changes must be accompanied by special phenomena in other parts of the globe. Accordingly we find quite anomalous winter conditions, namely, a mild winter and a cold spring over the United States and Canada, a long-continued drought in Australia, heavy ice and storms in the North Atlantic, unusual snows and cold weather in Austria and Germany, great typhoons in the Pacific, and so on for other regions. This whole series of atmospheric phenomena is connected together; an unusual event in one region brings corresponding phenomena in another, while, for aught we know, the atmosphere as a whole may preserve the same average temperature, moisture, and motion. We must seek for the initial disturbance in our atmosphere and on our earth. We need not go far away to study the sun and its possible variability of radiation or the moon and its tidal influence until we have mastered the intricacies of our terrestrial conditions. It is not wise to devote much time to the study of the minute atmospheric variations that may possibly result from possible variations in external influences while the great variations—the droughts and floods, the monsoons and storms inherent to all atmospheric processes—are still awaiting profound study. Solar physics and molecular physics certainly have important applications to meteorology, but the mechanics of the atmosphere is the important study for the meteorologist, and we earnestly invite the young American students of science to undertake this important subject.

CHAVANNE'S TEMPERATURE AND RAINFALL IN ARGENTINA.

We have already, in the MONTHLY WEATHER REVIEW for June, 1902, page 315, referred to the great work being done by Mr. Walter G. Davis for the whole of Argentina. He has published many volumes of climatological data and also an elaborate general climatological report in the first volume of the Second Official National Census. Lately he began the publication, for the Argentine Department of Agriculture, of a daily weather map, which may be considered as a national extension of the daily map of Buenos Ayres published for the last ten years by the Observatory of La Plata.

We recently received from Dr. Josef Chavanne an important memoir on the temperature and rainfall of Argentina, which lately appeared in the first volume of the Publications of the German Academic Association at Buenos Ayres. Dr. Chavanne has been known for many years as a prominent student of meteorology and geography. He was born in Gratz in 1846 and traveled extensively in America and Africa; his previous memoirs have been published by the geographical, meteorological, and other societies in Vienna. It was with great pleasure that we welcomed this memoir on the climate of Argentina, as indicating the addition of another trained climatologist to the able men who have, for some years, been located in that republic. But, while compiling this notice of his latest work, we have been pained to learn, by a letter from Madame Chavanne that her husband died on December 7, 1902, the very day on which his memoir was received in Washington.

Dr. Chavanne begins his memoir by emphasizing the ease with which European emigrants adapt themselves to the climate of Argentina, which can now be studied in detail by means of the records of about 400 stations and especially since the topographic maps of the republic now possess a sufficient degree of accuracy. Chavanne notes that previous studies have often led to erroneous conclusions because the data related to different years at different stations. He has, therefore, reduced all of his rainfall records to the fundamental 40-year period, 1861–1900, and his temperature records to the fundamental 45-year period, 1856–1900. For the purpose of comparison with the stations in Chili, he reduces the latter to the 30-year period, 1861–1890; but the other foreign stations are reduced to the same fundamental period, 1856–1900, as that adopted for Argentina. The temperature and rainfall for the year and the four seasons, as well as the ranges of temperature, the anomalies of temperature and the characteristic of the vegetation covering the surface, are also shown in charts, so that we have a decided addition to our knowledge of the relation between climate and vegetation.

Chavanne's climatic charts of Argentina extend from latitude 22° southward to 55°, and partially include the western or Chilian coast. He considers the climate to be not only primarily influenced by the sunshine but to have an additional annual period depending upon the alternating prevalence of the warm Brazilian and the cool Falkland currents on the east coast, the increasing elevation as we go westward up to the Andes, the prevalence of the cold Peru current on the coast of Chili, and the variable characteristics of the surface, as modified by vegetation.

This complex of climatological factors brings about a subdivision of the Argentine territory into five general climatic subregions, three of which should be again subdivided into two. These nine regions are as follows:

1. Northern coast, a subtropical climate having mean daily temperatures above 20° C. (68° Fahr.) for from five to seven months and above 10° C. (50° Fahr.) for the rest of the year.
2. Southern coast, temperate climate; mean daily temperatures above 10° C. during eight to twelve months.
3. Northern interior, subtropical climate; temperature above 20° C. during five to eight months and the rest above 10° C.
4. Southern interior, temperate climate; temperatures above 10° C. during eight to twelve months.
5. The region of the steppes and the so-called local zondas, subtropical climate; temperatures above 20° C. during five to seven months, the rest above 10° C., but having a temperate or even a cold climate at locations whose altitudes exceed 1500 meters.
6. The northern Andean region, having a temperate climate at altitudes of 1300-3600 meters, with temperatures above 10° C. during eight to twelve months, but having a subtropical climate for localities below 1300 meters.
7. The southern Andean region, having a temperate climate up to altitudes of 1800 meters with temperatures above 10 C°

during six to nine months, but a cold climate at altitudes above 1800 meters, with temperatures above 10° C. during one to three months.

8. The eastern Patagonian region, temperate climate, with temperatures above 10° C. during four or five months.

9. The western Patagonian and Staten Island region, a cold climate, having temperatures above 10° C. during one to five months according to the altitude and longitude. Staten Island has no month with mean temperature above 10° C.

THE ZONDAS.

In the course of his more detailed remarks on the peculiarities of each of these climatic regions Dr. Chavanne mentions the zondas as a special characteristic of the elevated steppes. These are local hot winds, whose origin and effects are due to the local topography, the general configuration of the orography and the peculiarities of the surface of the land, as to the amount of sand, clay, and boulders. They occur with great frequency and regularity in the summer months and in the afternoon hours, often blowing with the strength of a gale or storm; during their prevalence the temperature rises by from 10° to 19°, while at the same time the relative humidity sinks to 0 per cent.

[It is evident that here we have to do with a phenomenon analogous to the hot, dry winds of Kansas and Nebraska. These are exaggerated or intensified illustrations of the foehn winds of Switzerland, the chinook winds of Montana, and of the afternoon gale that descends from Table Mountain into the streets of Cape Town. The temperature of the ground does not add much to the temperature of these winds; the latter is due primarily to the compression and dynamic warming of air forced down from moderate heights in the atmosphere; the hot winds descend as well during the night as during the day. The time when, the place where, and the reason why they descend is not yet clearly understood.—ED.]

TEMPERATURE GRADIENT.

A study of the diminution of temperature with altitude shows that on the average for all these surface stations the vertical temperature gradient ranges between 0.55° C. and 0.20° C. per 100 meters, the general average being 0.35° C. The diminution of temperature with latitude is on the average much larger in the eastern portion of the republic and at sea level, where it amounts to about 0.6° C. per degree of latitude; it is much less in the western or mountainous regions, where it amounts to 0.21° C. per degree of latitude.

Chavanne's detailed tables of temperature and rainfall will probably furnish an excellent guide for the selection of plants intended for importation into or export from Argentina. They will also serve as a basis for special phenological studies.

THE WEATHER IN VENEZUELA.

Mr. E. H. Plumacher, United States Consul at Maracaibo, under date of March 19, says:

> We are having here very unusual weather. It blows every day with great velocity, but without a cloud in the sky. It seems that in the upper strata a fine dust is moving, which gives the sky a hazy hue. The velocity of the wind is that which is called a "double-reefed topsail" wind. Outside of the bar and in the Gulf of Maracaibo the navigation has been rough and steamers leaving port have had very unpleasant voyages. We have never experienced such weather in this section of Venezuela, and consequently the country is suffering greatly. Since September, 1902, we have not had any rains, and consequently sickness abounds from using bad water. During the first twenty days of this month we have had five slight seismic movements.

THE CUBAN METEOROLOGICAL SERVICE.

Mr. W. C. Devereaux, Observer Weather Bureau, reports from Havana, Cuba, under date of April 11, that the Cuban Meteorological Service was officially inaugurated on that date, at 12 o'clock noon, by the president of the republic, by dropping the time ball. Señor Enrique A. Del Monte is chief of the central station for meteorology, climatology, and crops (meteorologia, climatologia y cosechas), and informs us that, "beginning with April 13, 1903, he will take observations every two hours, from 8 a. m. to 4 p. m., inclusive."

It seems fair to assume that this latter expression relates to complete personal records, including clouds and miscellaneous phenomena, and that the ordinary records of maximum and minimum temperatures and the continuous registers of temperature, pressure, wind, rain, and sunshine will be kept up by means of the proper apparatus, as at all first class stations. Meteorology is indebted to Félipe and Andrés Poey for meteorological records at Havana many years ago, which were at that time deemed among the most elaborate of their kind. Continuous registers have also been maintained at the Colegio de Belen since 1873, by the use of the Secchi meteorograph. We also owe to Señor Del Monte himself the establishment of the meteorological observatory at the Vedado Park and the series of observations published in the MONTHLY WEATHER REVIEW for April, 1900. The advantageous location of the new central meteorological office and the introduction of the newest type of self-registering apparatus will, it is hoped, give increased precision and reliability to the new series of records. As there has not yet been devised any satisfactory continuous register of the ventilated wet-bulb thermometer or of the ventilated dew-point apparatus, we must regard it as a distinct addition to our knowledge of West Indian climates that Señor Del Monte is maintaining a series of personal observations of the moisture of the air at intervals of two hours—from 8 a. m. to 4 p. m.

STUDENT ASSISTANTS IN THE UNITED STATES WEATHER BUREAU.

A recent note from Dr. O. L. Fassig, Section Director, United States Weather Bureau, Baltimore, Md., states that—

> Mr. Benjamin L. Miller, who during the past two years has held the position of student assistant in the Baltimore office of the Weather Bureau, has been appointed assistant in geology in Bryn Mawr College. Dr. Miller completed his studies in the Johns Hopkins University in February, 1903, receiving the degree of Ph. D. on February 23.
>
> In addition to instruction in geology at Bryn Mawr, Dr. Miller will give a course of two hours per week throughout the year in meteorology, which has heretofore not been taught as a separate study in this institution.

During the past five years, and in addition to his specific Weather Bureau work, Dr. Fassig has actively maintained a course of instruction in meteorology for the students of the Johns Hopkins University; probably thirty or more post graduates have attended these lectures. Several of these are now giving courses in meteorology in other institutions. The two student assistants annually allowed to the Baltimore office have, we believe, also been students of geology and physics and have attended these meteorological lectures. Although the student assistants of the Weather Bureau generally enter its service, yet we shall not fail to recognize the great importance of the work that they may do outside of the service as teachers of climatology. The future progress of the higher meteorology depends upon securing here and there a man of genius from among the thousands who have studied climatology and meteorology under the earnest teachers of our colleges and universities.

AN ARCTIC MAGNETICAL AND METEOROLOGICAL STATION.

A letter addressed to Dr. L. A. Bauer, of the United States Coast and Geodetic Survey, from Christiania, Norway, dated April 1, from Roald Amundsen, leader of the Norwegian Magnetic North Pole Expedition, states that he will start in May

for Lancaster Sound where he will establish a magnetic station, as also another one farther west. These will be maintained for three years. Although the primary object is magnetic work, meteorological observations will undoubtedly also be taken, and these records in latitude 73° to 75° north and longitude somewhere between 80° and 120° west, must throw much light upon the origin and limiting boundaries of our great areas of high pressure and low temperature. From what we can learn from the daily weather maps of the United States and Canada, we have been led to the belief that cold waves originate in clear air, cooling by radiation on the eastern slope of the Rocky Mountains in the region covered by the watershed of the Mackenzie, Athabasca, and Saskatchewan rivers. On the other hand, the accounts of the cold winds experienced farther north make it quite probable that other areas of cold air accumulate over the frozen Arctic Ocean and the northern Archipelago and in extreme cases the outflow from this region may also contribute to the blizzards of the United States, while in ordinary cases this cold air may only flow as far southward as Hudson Bay and Labrador.

The north magnetic pole is ordinarily located in the little known region between Lancaster Sound and King Williams Land. The stations occupied by Amundsen will lie to the north of this pole, and his three years of observation will undoubtedly give its present location with great accuracy.

WILLIAM KAUCHER.

Mr. William Kaucher, one of the oldest voluntary observers of the Weather Bureau, died at his home at Oregon, Mo., on March 5, 1903, in his 72d year. He was born in Berks County, Pennsylvania, November 22, 1831, and his early youth was spent in Germantown, Ohio, where he received his education and learned the millwright's trade. Coming to the West in 1855 he located at Oregon, residing there until his death. For many years he followed his trade as millwright and was identified with the erection of many steam mills in that section of the State, and also in Iowa, Nebraska, and Kansas, and at different times was also engaged in milling and other manufacturing enterprises. He was a great student and accumulated a library of some 12,000 publications. Upon locating at Oregon he began systematic observations of temperature, precipitation, and other meteorological phenomena, which he continued until a short time before his death, and Missouri is indebted to him for one of the longest and most accurate meteorological records ever kept in the State. His connection with the Weather Bureau as a voluntary observer dates from the early seventies.

Strong in purpose for the right, wise in council, kind and charitable toward all, he lived, as all should live, an unselfish life, doing ever what needed to be done and striving always to advance the best interests of his fellow men. In his death Missouri has lost one of her noblest citizens, and the Weather Bureau one of its staunchest friends and most faithful observers.—*A. E. Hackett, Section Director.*

THE FIRST USE OF THE WORD "BAROMETER."

The following article, by A. Lawrence Rotch, (dated Blue Hill Observatory, April 13, 1903,) is reprinted from Science, New York, Vol. XVII, page 708:

I quite agree with Dr. Bolton's conclusion that Robert Boyle introduced the word "barometer" into our language about the year 1665 (Science, p. 548). Although Dr. Bolton finds that the first use of the word by Boyle was in the *Philosophical Transactions* of 1666, yet he suspects him to be the author of an anonymous communication to that journal the previous year, in which the "suspended Cylinder of Quicksilver" was called a "Barometer or Baroscope." For conclusive proof that Boyle really used these terms in the year 1665, I would cite a work that appears to have escaped Dr. Bolton's notice, viz., "The General History of the Air * * * by the Hon. Robert Boyle, Esq.," published in London in 1692, which contains "A short Account of the Statical Baroscope, imparted by Mr. Boyle, March 24, 1665." In this letter to Mr. H. Oldenburgh, Boyle describes the instrument as some large and light glass bubbles, counterpoised in a pair of scales, and placed near a "Mercurial Baroscope" (also called a "Barometer" in the same letter), from which he might learn the present weight of the atmosphere. The same work contains probably the earliest systematic register of thermometer, barometer, hygrometer, wind and weather in England, viz., that kept by J. Locke, the philosopher, at Oxford and at London, between 1666 and 1683, with interruptions. The reading of the mercurial barometer, designated at first "baroscope," was recorded in inches and tenths, but in another register, kept at Townley, in Lancashire, during a portion of the years 1670 and 1671, it was recorded to hundredths of an inch.

Professor G. Hellmann, the eminent German meteorological bibliographer and historian, although cognizant of Boyle's "General History of the Air," seems to be unaware of the letter quoted, since he also states in the introduction to No. 7 of his "Neudrücke von Schriften und Karten über Meteorologie und Erdmagnetismus" that the word "barometer" was first used by Robert Boyle in 1666, whereas it is certain, from what I have shown, that Boyle had already employed it the year before.

NOTES ON THE BAROMETRIC PRESSURE AT COLON AND ALHAJUELA.

In order to obtain the correction to the barograph at Alhajuela, the reduced sea level pressure, 763.51 millimeters (30.060 inches), at that place has been compared directly with the mean pressure, 759.62 millimeters (29.907 inches), for Bridgetown, Willemstad, and Port of Spain. The record of eight months gives 758.60 millimeters (29.867 inches), and as this is probably correct for the year, it should not differ so much from 759.62, if the correction is to be found for the instrument as General Abbot has done. But by Chart 29, Year, West Indies, of the Barometry Report, it is seen that the isobars do not run parallel to the circles of latitude, so that the mean pressure of the eastern stations can not be assumed as applicable to Alhajuela. The pressure is evidently considerably lower, although it is not possible to draw the isobars from the data at hand. The difference, 763.51 — 759.62 = 3.89 millimeters, can not be taken as the barograph error, and the evidence is that it should be at least one millimeter greater, though the exact amount is unknown.—*F. H. B.*

The article by General Henry L. Abbot, on page 124 of this REVIEW, endeavors to obtain the mean annual pressure at the Isthmus of Panama by combining together eight months of the record at the United States Weather Bureau station at Colon and three and a half years of record at Alhajuela by the barograph belonging to the new Panama Canal company. In the course of this work the author seems to assume that the annual mean barometric pressure (reduced to mean sea level at the Isthmus) will not materially differ from the annual mean at sea level for the three West Indian stations: Bridgetown, Willemstad, and Port of Spain, Trinidad. But this assumption is not justified by what we know of the distribution of pressure in the equatorial regions. The annual isobars published first by Buchan in 1868 for the whole world and by many other authorities since then, unite in showing that the equatorial belt of low pressure wanders around irregularly. The most recent isobaric charts for the West Indies are the thirteen prepared by Prof. F. H. Bigelow and published as Chart XXIX in his report on the barometry of the United States, Canada, and the West Indies. In this series the last, or annual, chart indicates that the pressure at Colon and Panama may be considerably less than 29.90, which is the average of Bridgetown (29.92), Willemstad (29.88), and Port of Spain (29.89).

It is possible to combine the records for Colon and Alhajuela without reference to the above-mentioned objectionable assumption. The two stations are so near together that the monthly and annual mean pressures at sea level, for each are not likely to differ appreciably. We may therefore assume that

during those months for which we have simultaneous records the differences between the Colon barometer and the Alhajuela barograph ought to give us a correction nearly uniform from month to month and therefore applicable throughout the year.

Fortunately the Weather Bureau has records for 7:40 a. m. local time at Colon during August, September, and October, 1902. The observations were made with a standard mercurial barometer properly reduced to standard gravity and sea level. The resulting mean pressures for this one daily observation are 29.826, 29.850, and 29.872 inches, respectively. By conversion these become 757.56, 758.18, and 758.73 millimeters. These figures can be reduced to the average for twenty-four hours by applying the corrections given by the hourly tables for Alhajuela. These corrections are —1.10, —1.19, and —1.14 millimeters. Hence, the mean pressures at Colon at sea level for continuous records will be 756.46, 756.99, and 756.59 millimeters. Now General Abbot gives in his Table 2, page 125, the values for Alhajuela deduced from 24 daily observations, as reduced to sea level by his method, for each month from July, 1899, to December, 1902. Comparing his figures for August, September, and October, 1902, with those just given by us for Colon we find that his figures need a nearly uniform correction of —6.00 millimeters. If the Alhajuela barograph retained its instrumental corrections during these years without change and if the reduction to sea level has been properly done, then this latter comparison indicates that all the monthly means in General Abbot's Table, No. 2, need a correction of —6.00 millimeters in order to reduce them to the standard sea level pressure at Colon. This, therefore, gives for the latter place a mean annual pressure of 757.51 millimeters, or 29.823 inches, as the average for three and a half years' record. Although this conclusion agrees closely with the ordinary charts of isobars yet it needs confirmation. It is greatly to be regretted that the Weather Bureau record is so fragmentary, and that the French record does not include the standard mercurial barometer.—*C. A.*

CORRIGENDA.

MONTHLY WEATHER REVIEW, May, 1899, Vol. XXVII, page 198, column 2, fig. 1, last word of title, for "southeast" read "southwest"; line 27 from the bottom, for "91" per cent read "51." Page 200, column 1, line 8, omit the words "on the coast." Page 202, column 1, line 17 from bottom, for "report" read "connection"; column 2, Table 14, December, 1887, for "16.28" read "12.68."

MONTHLY WEATHER REVIEW October, 1899, page 493, Vol. XXVII, Table III, Bridgetown 5 p. m. for "89.6" read "80.6."

MONTHLY WEATHER REVIEW, OCTOBER, 1900, Vol. XXVIII, page 467, Willemstad, 1 a. m., for "75.9" read "79.5."

MONTHLY WEATHER REVIEW for December, 1902, p. 567, column 2, rainfall table. The stations "Laniakea (Nahuina)" and the station "Upper United States Experiment station (Castle)" are identical. The former name is preferred by Mr. Lyons.

The Station "Vealia" is the same as "Kealia" and the former name should be omitted.

The station "Wahiawa" and the station "Wahiawa (Mountain)" are the same; the latter name is preferred; the elevation is uncertain but is believed to be about 3000 feet.

MONTHLY WEATHER REVIEW for January, 1903, page 31, headline, for "Division of Records and Meteorological Data," read "Division of Meteorological Records."

MONTHLY WEATHER REVIEW for February, 1903, page 69, transpose the numbers and titles of figs. 2 and 1; column 2, line 5, for "fig. 2" read "fig. 1". Page 70, transpose the numbers and titles of figs. 4 and 3.

MONTHLY WEATHER REVIEW for March, 1903, page 127, column 2, line 17, dele "also". Page 128, column 2, line 2, "nue" read "neu". Page 128, column 2, fig. 3, title for "focus" read "forces". Page 129, column 1, line 17, dele "of the". Page 132, column 1, line 1, for "systems" read "system"; column 1, line 26, "north-south" read "north-and-south"; line 27, "east-west" read "east-and-west"; column 1, line 6 from bottom, for "two" read "too"; column 1, note 5, for "42" read "43".

THE WEATHER OF THE MONTH.

By Mr. P. C. DAY, temporarily in charge of Division of Meteorological Records.

CHARACTERISTICS OF THE WEATHER FOR MARCH.

PRESSURE.

The distribution of mean atmospheric pressure is graphically shown on Chart IV and the average values and departures from normal are shown in Tables I and VI.

The chart of normal pressure over the United States and Canada for March shows an area of high pressure, slightly above 30.05 inches, over the region south of the Ohio and east of the Mississippi rivers, and extending eastward to the coast line of the South Atlantic States and the Florida Peninsula. Another area of about equal barometric pressure covers the greater part of Minnesota and the two Dakotas, while a third approaches the coast line of northern and central California.

For March, 1903, the area of high pressure, normal over the Appalachian region, lay far to the northeastward and covered the Middle Atlantic States, New England, and Canadian Maritime Provinces with pressure slightly above 30.20 inches. An area of low pressure, about 29.90 inches, is normal over New Mexico and Arizona, and during the current month covered this region with slightly increased pressure, and extended northwestward over Nevada into Oregon and Washington.

The pressure for the current month was above the normal over the entire region east of the Continental Divide, with marked departures over the eastern portion, ranging from +0.15 over the Middle Atlantic States to +0.35 over the more easterly Canadian Provinces. Over a small area west of the Rocky Mountains the pressure was slightly below the normal.

Compared with similar values for February, 1903, the pressure showed a marked increase over all the territory east of the Mississippi River and north of the east Gulf States, extending eastward into the north Atlantic Ocean. At St. Johns, Newfoundland, the average pressure for March showed an increase over that of the previous month of more than half an inch. Over all the country west of the Mississippi River the pressure decreased from that of February, attaining a maximum negative departure of 0.30 inch or more over the middle Plateau region.

TEMPERATURE OF THE AIR.

The distribution of maximum, minimum, and average surface temperatures is graphically shown by the lines on Chart VI.

Under the influence of the high pressure covering the northeastern part of the country, the normal westerly and northwesterly winds gave way to warm easterly and southerly winds over nearly the entire region east of the one hundredth meridian, which, with a percentage of cloudiness much above the normal, gave for practically the entire month equable temperatures, both day and night, with monthly means far above the average, and at many points higher values than before recorded during the period of observation.

Over large areas in the lower Lake region, the Middle Atlantic States, and New England the average for the month exceeded the normal by from 10.0° to 12.0°. At many points in this region the month will be remembered as the most remarkable on record as regards thermal conditions. At New

Haven, Conn., the mean for the current month, 44.6°, was the highest recorded during the period of one hundred and twenty-five years nearly continuous observation from 1779 to 1903. At New Bedford, Mass., the mean for the current month was the highest recorded in ninety-one years; at Philadelphia, Pa., the highest in seventy-eight years.

In sharp contrast to the above area of positive departures from the normal temperature, was a small area of negative departures over northern Montana and extending into the Canadian Northwest Territories, where the mean temperature for the month averaged 10° or more below the normal.

Maximum temperatures of 80°, and slightly above, occurred over the southern tier of States and Territories, with small areas of 90°, or slightly above, over the lower Rio Grande Valley and western Arizona and southeastern California.

Minimum temperatures as low as —30° were recorded at some of the elevated stations in Wyoming and Colorado, but elsewhere, as a rule, extreme cold did not occur. The line of freezing temperature extended well into Texas and into the central part of the cotton growing States.

The average temperatures for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	8	40.7	+ 8.6	+11.7	+ 3.9
Middle Atlantic	12	48.4	+ 9.1	+11.5	+ 3.8
South Atlantic	10	59.7	+ 6.8	+ 7.0	+ 2.3
Florida Peninsula*	8	70.6	+ 5.2	+ 7.8	+ 2.6
East Gulf	9	61.3	+ 3.5	+ 0.3	+ 0.1
West Gulf	7	59.0	+ 1.2	— 0.7	— 0.2
Ohio Valley and Tennessee	11	52.0	+ 7.8	+ 6.4	+ 2.1
Lower Lake	8	42.1	+ 9.8	+10.6	+ 3.5
Upper Lake	10	35.6	+ 9.0	+12.3	+ 4.1
North Dakota*	8	23.3	+ 3.0	+ 4.3	+ 1.4
Upper Mississippi Valley	11	42.3	+ 6.5	+ 8.5	+ 2.8
Missouri Valley	11	38.9	+ 3.5	+ 5.4	+ 1.8
Northern Slope	7	29.7	— 2.2	+ 2.6	+ 0.9
Middle Slope	6	42.2	+ 0.2	0.0	0.0
Southern Slope*	6	49.4	— 1.0	— 2.9	— 1.0
Southern Plateau*	13	46.6	— 1.0	— 4.4	— 1.5
Middle Plateau*	8	37.1	— 0.9	—12.4	— 4.1
Northern Plateau*	12	38.0	+ 0.2	+ 3.0	+ 1.0
North Pacific	7	43.0	— 2.1	+ 0.8	+ 0.3
Middle Pacific	5	51.0	— 1.4	— 4.3	— 1.4
South Pacific	4	55.0	0.0	— 1.2	— 0.4

*Regular Weather Bureau and selected voluntary stations.

In Canada.—Prof. R. F. Stupart says:

Over the Northwest Territories and British Columbia the month was colder than average. The greatest positive departure, about 12°, occurred near the shores of the Georgian Bay and in the upper Ottawa Valley, from which districts the differences from average became gradually less westward to the western boundary of Manitoba, where it was nil, and eastward to Prince Edward Island, where it was positive to the extent of about 4°. The largest negative departures were between 9° and 12° in southern Alberta.

PRECIPITATION.

The distribution of total monthly precipitation is shown on Chart III.

The precipitation for the month, except in small areas, showed but slight variation from the normal.

Over small areas on the immediate coast of Texas and Louisiana, eastern Florida, the New England coast and over western North Carolina, northern Georgia, and eastern Tennessee heavy rainfalls occurred.

At Corpus Christi, Tex., the amount for the month was 6.0 inches above the normal; at New Orleans, La., the average was exceeded by more than 9.0 inches, and at Jupiter, Fla., by more than 6.0 inches.

Although the rainfall was not generally above the average, the relative humidity showed marked increase above normal values, the only section showing a negative departure was North Dakota. In the east Gulf States and the middle and southern slope regions the values were 11, 14, and 17 per cent above the normal, respectively.

The amount of snowfall for the month, except in the mountain regions was generally deficient. Over New England the fall was remarkably light.

At the end of the month but little snow remained on the ground, except in extreme northern Maine, northern Michigan, and Minnesota, and on the elevated and protected points of the Rocky and Sierra Nevada mountains.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 20. Arizona, 9, 24, 25, 26. Arkansas, 4, 5, 6, 7, 8, 19. California, 3, 4, 5, 8, 13, 14, 16, 17, 24, 30, 31. Colorado, 18. Connecticut, 28. Georgia, 20, 21. Idaho, 16, 26, 28, 29, 30, 31. Illinois, 7, 17, 19, 20. Indiana, 7. Iowa, 5, 7, 16, 17, 19, 27. Kansas, 6, 7, 9, 18, 23, 26. Kentucky, 7, 20. Louisiana, 7, 19, 25, 27, 28. Maine, 5, 22, 23, 31. Maryland, 30. Massachusetts, 28, 29. Michigan, 16, 18. Minnesota, 17, 18, 19, 26. Mississippi, 19. Missouri, 6, 7, 8. Nebraska, 18, 26. Nevada, 4, 5, 8, 14, 16, 17, 24, 25, 28, 29, 30, 31. New Hampshire, 23, 24, 30. New Jersey, 24, 30. New Mexico, 25. New York, 24, 25, 28, 30. North Carolina, 29. Ohio, 7, 20. Oklahoma, 6, 7, 18. Oregon, 3, 4, 5, 6, 7, 8, 9, 11, 12, 15, 28, 29, 30. Pennsylvania, 5, 30. Rhode Island, 31. South Dakota, 9, 17, 18, 31. Tennessee, 8, 20, 29. Texas, 6, 7, 8, 9, 18, 19, 20, 24, 26, 27. Utah, 5, 6, 15, 16, 17, 18, 25, 29, 31. Vermont, 30. Virginia, 23. Washington, 6, 7, 8, 11, 12, 17, 28, 30, 31. West Virginia, 29. Wisconsin, 15, 16, 18. Wyoming, 30, 31.

SLEET.

The following are the dates on which sleet fell in the respective States:

Arizona, 16. Arkansas, 19, 29. California, 3, 4, 5, 8, 12, 13, 14, 16, 17, 24, 31. Colorado, 5, 12, 13, 14, 15, 17, 18, 20, 30, 31. Delaware, 30. Illinois, 4, 6, 20, 23, 27. Indiana, 23, 24, 28. Iowa, 4, 22, 23, 26, 27. Kansas, 5, 14, 15, 22, 23, 26, 27. Maine, 10, 21, 23, 31. Maryland, 21, 30. Massachusetts, 3, 11, 23, 28, 29, 30. Michigan, 5, 6, 16, 17, 19, 20, 23, 24, 27. Minnesota, 9, 13, 14, 15, 16, 19, 20, 26. Missouri, 5, 7, 20, 23, 27. Montana, 16, 17. Nebraska, 5, 11, 13, 14, 15, 16, 18, 21, 25, 26. Nevada, 8, 13, 14, 24, 31. New Hampshire, 28, 30, 31. New Jersey, 24, 30. New York, 5, 24, 25, 28, 30, 31. North Carolina, 29. North Dakota, 7. Ohio, 23, 28. Oregon, 8, 9, 11, 13, 14. Pennsylvania, 5, 29, 30. South Dakota, 13, 15, 16, 18, 19, 21, 22, 26. Tennessee, 2, 24, 29, 30. Texas, 1, 2, 20. Utah, 4, 5, 6, 18, 25, 31. Virginia, 23, 29, 30. Washington, 3, 6, 7, 8, 9, 10, 11, 17, 28. West Virginia, 29, 30. Wisconsin, 4, 5, 16, 20, 21, 23, 24. Wyoming, 4, 5, 6, 16, 18, 26, 31.

In Canada.—Professor Stupart says:

The total precipitation of the month was less than average over the larger part of British Columbia, and even on the coast a portion of it was snow. In the Northwest Territories and Manitoba, where it was almost wholly snow, there were no pronounced differences from average. In Ontario there was practically no snow except along the north shore of Lake Superior, and the rainfall was in most localities a little short of the average, especially in the more central counties. In Quebec there was little or no snow, and the rainfall, which was just average at Montreal, was somewhat above average farther east. Over the larger part of the Maritime Provinces the precipitation was considerably in excess of the average, and in northern districts was partly snow, while farther south it was almost wholly rain. From a very limited number of reports it would appear that there is less snow on the ground in the northern portions of Cariboo than is usual at this date. There is still a considerable covering in Northern Alberta and in Saskatchewan, and the prairies of Southern Alberta and Assiniboia are not entirely bare, and even in Manitoba it was only during the last few days of the month that the sleighing disappeared. In Ontario, except in the extreme east and north, the ground was bare early in the month. In Quebec there is still snow on the ground from Quebec City eastward, and considerable snow still lies in the woods of northern New Brunswick.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	8	5.67	147	+1.8	+1.9
Middle Atlantic	12	4.75	123	+0.9	+1.5
South Atlantic	10	5.06	113	+0.6	+1.6
Florida Peninsula *	8	5.94	202	+3.0	+7.8
East Gulf	9	7.48	134	+1.9	+6.6
West Gulf	7	4.81	141	+1.4	+3.4
Ohio Valley and Tennessee	11	4.66	107	+0.3	+0.2
Lower Lake	8	2.72	108	+0.2	+0.4
Upper Lake	10	2.33	115	+0.3	−0.6
North Dakota *	8	0.41	51	−0.4	−0.6
Upper Mississippi Valley	11	2.30	100	0.0	−1.0
Missouri Valley	11	1.53	84	−0.3	−0.6
Northern Slope	7	0.88	100	0.0	−0.1
Middle Slope	6	1.34	100	0.0	+0.2
Southern Slope *	6	1.47	137	+0.4	+2.2
Southern Plateau *	13	1.31	144	+0.4	−0.5
Middle Plateau *	8	1.43	108	+0.1	−0.1
Northern Plateau *	12	1.36	93	−0.1	−1.8
North Pacific	7	4.76	92	−0.4	−4.6
Middle Pacific	5	5.47	138	+1.5	−0.3
South Pacific	4	3.84	171	+1.6	+0.3

*Regular Weather Bureau and selected voluntary stations.

HUMIDITY.

The averages by districts appear in the subjoined table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	82	+ 7	Missouri Valley	77	+ 5
Middle Atlantic	79	+ 7	Northern Slope	72	+ 5
South Atlantic	81	+ 6	Middle Slope	74	+14
Florida Peninsula	80	+ 6	Southern Slope	72	+17
East Gulf	84	+11	Southern Plateau	40	+ 4
West Gulf	78	+ 6	Middle Plateau	62	+ 6
Ohio Valley and Tennessee	79	+ 8	Northern Plateau	68	+ 2
Lower Lake	83	+ 7	North Pacific	75	0
Upper Lake	82	+ 3	Middle Pacific	78	+ 4
North Dakota	76	− 2	South Pacific	74	+ 3
Upper Mississippi Valley	78	+ 5			

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 2149 thunderstorms were received during the current month as against 2035 in 1902 and 802 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country was most numerous were: 7th, 341; 20th, 230; 19th, 193.

Reports were most numerous from: Ohio, 127; Missouri, 119; Illinois, 112; Tennessee and Texas, 111.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz: 9th to 17th.

In Canada: Thunderstorms were reported at Bissett, 20th; Toronto, 20; Port Stanley, 20; Parry Sound, 18, 20. No auroras were reported.

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Buffalo, N. Y	1	56	w.	New York, N. Y	25	52	nw.
Do	20	51	w.	North Head, Wash	9	60	s.
Cape Henry, Va	30	54	ne.	Do	10	90	s.
Charleston, S. C	29	55	ne.	Do	30	58	s.
Chicago, Ill	23	50	sw.	Point Reyes Light, Cal	8	64	nw.
Do	24	52	sw.	Do	9	54	nw.
Columbus, Ohio	23	51	w.	Do	28	53	se.
Denver, Colo	18	51	n.	Do	30	50	s.
Detroit, Mich	24	50	sw.	Syracuse, N. Y	7	56	s.
Dodge, Kans	17	50	s.	Tatoosh Island, Wash	9	66	sw.
Indianapolis, Ind	23	50	sw.	Do	13	54	e.
Marquette, Mich	30	50	sw.	Do	28	55	s.
Mount Tamalpais, Cal	8	52	nw.	Winnemucca, Nev	30	52	sw.
New York, N. Y	1	54	w.				

SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

The averages for the various districts, with departures from the normal, are shown in the following table:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	6.0	+ 0.4	Missouri Valley	5.5	− 0.1
Middle Atlantic	6.3	+ 0.8	Northern Slope	5.3	0.0
South Atlantic	6.5	+ 1.8	Middle Slope	5.2	+ 0.8
Florida Peninsula	5.5	+ 1.5	Southern Slope	4.0	− 0.2
East Gulf	7.5	+ 2.8	Southern Plateau	4.1	+ 1.1
West Gulf	6.3	+ 1.1	Middle Plateau	5.7	+ 0.8
Ohio Valley and Tennessee	7.0	+ 1.1	Northern Plateau	6.2	− 0.3
Lower Lake	6.6	+ 0.2	North Pacific	6.1	− 0.5
Upper Lake	6.5	+ 0.6	Middle Pacific	6.9	+ 1.9
North Dakota	5.6	+ 0.1	South Pacific	5.4	+ 0.9
Upper Mississippi Valley	6.0	+ 0.5			

DESCRIPTION OF TABLES AND CHARTS.

By Mr. W. B. STOCKMAN, Forecast Official, in charge of Division of Meteorological Records.

For description of tables and charts see page 582 of REVIEW for December, 1902.

TABLE 1.—*Climatological data for Weather Bureau Stations, March, 1903.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.			Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
New England.							**43.7**	**+ 3.6**									**82**	**5.67**	**+ 1.8**									**6.0**	
Eastport	76	69	74	30.11	30.20	+ .27	34.2	+ 5.5	49	12	40	4	3	28	32	32	29	84	4.98	+ 0.6	17	9,308	sw.	43	ne.	29	10	7	14	6.1	2.4
Portland, Me.	103	81	117	30.08	30.22	+ .26	39.1	+ 7.1	78	20	47	13	3	32	40	35	32	78	5.60	+ 2.3	15	7,112	nw.	38	sw.	1	11	4	16	6.1	3.6
Concord	298	70	79	29.89	30.21	+ .21	39.8	+ 8.6	77	20	49	16	2	31	42	....	....	....	5.00	+ 1.5	12	4,067	ne.	35	w.	1	8	8	15	6.5	5.2
Northfield	876	16	60	29.24	30.22	+ .22	37.6	+12.6	75	20	46	4	3	29	33	33	30	79	3.87	+ 1.0	14	6,508	s.	36	sw.	1	6	9	16	6.8	1.5
Boston	125	115	181	30.08	30.23	+ .26	44.4	+10.2	76	20	52	23	2	36	33	40	37	81	5.95	+ 1.8	14	7,968	sw.	34	w.	1	11	4	16	6.0	0.3
Nantucket	12	43	85	30.21	30.23	+ .25	42.2	+ 7.3	59	21	47	25	2	37	19	40	38	88	3.53	0.0	9	10,533	sw.	43	nw.	29	7	8	16	6.5	
Block Island	31	11	60	30.29	30.23	+ .25	42.2	+ 7.4	56	14	48	22	2	37	20	40	38	86	8.03	+ 4.0	13	12,029	sw.	45	ne.	30	11	5	15	5.6	
Narragansett	....	....	....	....	....	....	42.2	+ 8.9	61	14	50	19	2	35	30	....	....	....	8.95	+ 4.4	12	.....	n.	....	.....	...	13	4	14	....	
New Haven	106	117	140	30.10	30.23	+ .24	44.6	+10.0	66	20	52	23	2	37	26	41	37	78	5.09	+ 0.9	14	7,037	ne.	34	ne.	30	13	9	9	4.6	T.
Mid. Atlantic States.							**43.4**	**+ 3.1**									**79**	**4.75**	**+ 0.9**									**6.3**	
Albany	97	102	115	30.12	30.23	+ .22	43.2	+11.3	74	20	52	22	1	35	35	39	36	81	3.55	+ 0.9	13	6,258	s.	27	w.	1	6	11	14	6.6	2.6
Binghamton	875	79	90	29.25	30.21	+ .19	43.0	+12.2	74	19	51	21	2	35	33	....	....	....	3.84	+ 0.8	13	4,371	ne.	24	nw.	1	6	8	17	6.7	0.4
New York	314	108	350	29.86	30.21	+ .21	47.5	+10.6	67	14	54	28	2	40	22	43	39	78	3.65	— 0.3	11	9,311	e.	54	w.	1	8	8	15	6.2	
Harrisburg	374	94	104	29.81	30.22	+ .19	47.4	+11.2	70	14	56	26	2	39	31	42	38	73	3.76	+ 0.3	13	5,111	e.	34	nw.	1	7	6	18	6.8	T.
Philadelphia	117	168	184	30.10	30.23	+ .21	49.4	+10.3	72	20	58	30	2	41	32	44	39	75	4.38	+ 1.1	10	7,707	sw.	38	s.	23	10	7	14	5.7	T.
Scranton	805	111	119	29.33	30.21	+ .19	45.8	.....	72	19	55	24	2	37	37	40	35	72	4.40	.....	12	5,393	sw.	31	w.	1	6	7	18	7.4	T.
Atlantic City	52	39	48	30.16	30.23	+ .21	45.3	+ 7.7	61	28	51	27	2	40	22	43	41	87	5.71	+ 1.8	11	6,646	sw.	31	se.	30	11	7	13	5.4	
Cape May	17	47	51	30.21	30.24	+ .23	46.2	+ 6.7	62	27	51	30	2	41	18	44	....	....	6.25	+ 1.9	12	6,198	s.	34	ne.	30	10	8	13	6.0	
Baltimore	123	69	117	30.07	30.21	+ .18	49.6	+ 8.1	72	28	57	29	2	42	31	45	40	75	4.40	+ 0.3	13	4,938	se.	32	w.	1	11	7	13	6.0	
Washington	112	59	76	30.09	30.21	+ .17	50.0	+ 8.7	74	20	59	25	2	41	31	46	43	83	5.73	+ 1.6	12	5,144	s.	31	nw.	28	8	11	12	6.1	T.
Cape Henry	18	5	58	30.17	30.19	+ .16	51.8	+ 6.6	77	24	59	36	2	45	27	....	....	....	4.65	— 0.5	12	9,812	ne.	54	ne.	30	5	10	16	6.7	
Lynchburg	681	83	88	29.42	30.18	+ .13	52.8	+ 7.6	75	18	62	25	2	43	38	46	42	75	5.05	+ 1.4	10	3,185	ne.	20	ne.	30	10	9	12	6.0	
Norfolk	91	102	111	30.11	30.21	+ .18	54.6	+ 7.7	77	24	63	35	2	46	29	50	48	88	6.01	+ 1.4	13	7,006	ne.	37	ne.	30	11	7	13	5.8	
Richmond	144	82	90	30.05	30.21	+ .17	54.4	.....	76	20	64	31	2	45	30	....	....	....	8.14	.....	10	3,962	ne.	28	s.	23	10	6	15	6.2	
Wytheville	2,293	40	47	27.77	30.19	+ .14	49.3	.....	72	9	59	23	2	40	36	45	42	82	5.03	.....	11	3,425	e.	20	nw.	31	6	11	14	6.5	3.2
S. Atlantic States.							**50.7**	**+ 6.6**									**81**	**5.06**	**+ 0.6**									**6.3**	
Asheville	2,255	73	100	27.81	30.15	+ .09	52.4	+ 6.5	73	23	61	25	2	44	34	47	44	80	7.06	+ 2.9	15	6,059	se.	36	e.	30	3	12	16	7.2	T.
Charlotte	773	68	76	29.32	30.17	+ .12	57.4	+ 7.5	77	20	66	31	2	49	26	51	47	77	5.77	+ 1.0	12	4,986	ne.	32	ne.	29	6	10	15	6.6	
Hatteras	11	12	47	30.18	30.19	+ .15	58.2	+ 8.1	73	23	62	45	2	54	17	55	53	88	5.30	— 0.8	15	11,328	ne.	48	se.	30	3	14	14	6.8	
Kittyhawk	....	....	....	....	....	....	54.4	+ 7.0	72	*	61	39	5	48	26	....	....	....	5.53	+ 0.4	10	11,107	ne.	....	.....	....	8	6	17	6.5	
Raleigh	376	93	101	29.77	30.17	+ .12	57.4	+ 9.2	79	20	67	30	2	48	29	52	48	80	7.32	+ 3.3	14	4,673	ne.	28	ne.	30	8	10	13	5.9	
Wilmington	78	82	90	30.07	30.15	+ .10	60.6	+ 6.7	77	24	69	38	2	52	26	55	52	83	3.32	— 0.6	9	6,048	ne.	34	e.	29	5	14	12	6.4	
Charleston	48	14	92	30.10	30.15	+ .09	62.6	+ 5.9	78	21	68	46	2	57	18	58	55	82	3.44	— 0.5	12	7,931	ne.	55	ne.	29	2	22	7	6.1	
Columbia	351	114	122	29.78	30.17	+ .11	61.1	+ 6.9	80	20	69	36	2	53	25	55	52	79	3.90	— 0.6	11	5,745	ne.	38	ne.	29	4	11	16	6.7	
Augusta	180	89	97	29.95	30.14	+ .08	62.0	+ 6.5	80	20	70	39	2	54	30	56	52	77	5.95	+ 0.8	15	4,568	ne.	37	ne.	29	6	12	13	6.5	
Savannah	65	79	89	30.07	30.13	+ .07	63.9	+ 5.4	81	23	70	45	2	57	20	58	56	84	5.53	+ 1.8	13	5,962	e.	43	ne.	29	2	21	8	6.4	
Jacksonville	43	101	129	30.04	30.09	+ .03	66.8	+ 4.8	80	23	74	48	2	60	23	61	59	83	2.55	— 0.9	11	7,054	ne.	36	sw.	29	4	13	14	6.4	
Florida Peninsula.							**73.4**	**+ 4.7**									**80**	**5.76**	**+ 3.4**									**5.0**	
Jupiter	28	10	48	30.04	30.07	+ .02	73.7	+ 5.9	83	24	78	62	26	69	15	68	66	79	9.27	+ 6.3	17	9,381	ne	36	se.	29	8	14	9	5.5	
Key West	22	43	50	30.02	30.03	— .02	75.4	+ 2.7	83	23	80	67	29	71	13	70	67	78	3.23	+ 2.0	12	7,706	e.	36	w.	28	10	12	9	5.2	
Tampa	34	60	67	30.03	30.07	.00	71.0	+ 5.5	84	21	79	50	26	63	24	64	62	82	4.79	+ 2.0	14	4,829	ne.	27	s.	29	6	16	9	5.8	
East Gulf States.							**61.3**	**+ 3.5**									**84**	**7.48**	**+ 1.9**									**7.5**	
Atlanta	1,174	190	216	28.90	30.14	+ .08	57.0	+ 5.5	75	10	63	32	2	51	21	53	52	88	9.07	+ 3.3	15	8,534	se.	37	ne.	29	5	3	23	7.6	
Macon	370	93	99	29.73	30.13	+ .07	60.8	.....	79	20	68	35	2	53	27	....	....	....	5.38	.....	14	4,820	e.	36	ne.	29	3	5	23	8.1	
Pensacola	56	79	96	30.03	30.09	+ .03	62.6	+ 3.1	73	11	68	45	26	58	20	....	....	....	6.36	+ 0.9	15	7,021	e.	38	se.	14	4	14	13	6.8	
Mobile	57	88	96	30.03	30.09	+ .03	62.8	+ 3.9	75	17	69	44	26	57	23	58	55	81	6.63	— 0.9	13	4,966	n.	25	n.	25	3	9	19	7.6	
Montgomery	223	100	112	29.87	30.10	+ .04	61.4	+ 4.4	82	20	68	39	2	54	27	57	55	85	5.21	— 1.3	14	5,151	e.	26	ne.	29	3	8	20	7.8	
Meridian	375	84	93	29.70	30.10	+ .05	59.8	+ 2.4	79	6	67	32	26	52	33	....	....	....	4.45	— 1.1	16	4,554	ne.	19	nw.	23	3	11	17	7.7	
Vicksburg	247	62	74	29.79	30.06	+ .02	61.1	+ 3.1	80	17	68	36	1	54	24	56	53	83	6.00	— 0.4	13	5,034	n.	23	nw.	23	3	11	17	7.3	
New Orleans	51	88	121	30.01	30.06	+ .02	64.0	+ 2.0	82	7	71	45	2	58	20	59	56	83	14.61	+ 9.3	17	6,599	ne.	29	n.	21	5	7	19	7.4	
West Gulf States.							**59.0**	**+ 1.8**									**78**	**4.81**	**+ 1.4**									**6.3**	
Shreveport	249	77	84	29.83	30.10	+ .08	59.5	+ 1.9	79	16	67	33	1	52	24	53	49	74	2.89	— 1.8	12	5,210	se.	30	se.	7	6	8	17	6.6	
Fort Smith	457	79	94	29.61	30.10	+ .09	54.8	+ 4.8	78	31	64	23	1	46	29	48	43	70	3.96	+ 0.7	13	6,283	e.	42	w.	23	5	18	8	5.6	1.5
Little Rock	357	93	100	29.74	30.12	+ .09	56.4	+ 4.2	77	17	64	27	1	49	29	50	44	69	5.09	— 0.1	11	5,725	ne.	28	s.	6	11	12	8	5.3	T.
Corpus Christi	20	48	53	30.02	30.04	+ .06	62.3	— 0.5	76	9	68	42	1	57	19	59	57	86	7.69	+ 6.0	14	7,711	n.	37	se.	18	5	10	16	6.9	
Fort Worth	670	106	114	29.39	30.12	+ .14	54.1	.....	77	31	62	25	1	46	28	....	....	....	2.03	.....	7	6,972	n.	34	nw.	9	16	2	13	4.9	
Galveston	54	106	112	29.98	30.03	+ .02	62.0	— 0.5	75	16	66	41	1	58	15	59	58	89	8.11	+ 5.2	16	9,010	n.	46	nw.	19	6	11	14	6.4	
Palestine	510	73	79	29.55	30.08	+ .08	58.6	+ 1.0	78	31	66	30	1	51	26	53	49	78	4.66	+ 0.7	13	5,685	ne.	25	s.	9	4	9	18	7.3	T.
San Antonio	701	80	91	29.32	30.04	+ .06	59.2	— 2.7	79	31	67	35	1	51	28	54	51	77	1.29	— 0.8	7	6,042	se.	37	nw.	19	3	11	17	7.0	
Taylor	583	55	63	29.46	30.08	+ .09	57.6	.....	78	31	66	30	1	50	28	....	....	....	3.11	.....	9	6,982	n.	28	nw.	7	3	12	16	7.0	T.
Ohio Val. and Tenn.							**52.0**	**+ 7.6**									**79**	**4.66**	**+ 0.3**									**7.0**	
Chattanooga	762	106	112	29.35	30.18	+ .12	56.6	+ 6.1	75	18	63	31	2	50	25	51	47	76	6.22	+ 0.3	20	4,850	ne.	24	w.	24	5	7	19	7.3	
Knoxville	1,004	10	88	29.09	30.15	+ .09	55.8	+ 8.2	78	19	64	30	2	47	30	50	48	82	6.96	+ 1.6	18	4,709	w.	32	ne.	29	7	10	14	6.1	
Memphis	397	140	154	29.71	30.14	+ .10	56.4	+ 4.8	77	17	63	29	1	50	25	52	49	82	5.50	— 0.3	10	7,078	nw.	36	w.	29	4	8	19	7.3	
Nashville	546	122	131	29.58	30.18	+ .13	54.2	+ 5.5	76	19	62	29	1	47	31	50	46	81	5.17	0.0	15	4,887	s.	29	s.	7	6	6	19	7.2	
Lexington	989	75	102	29.08	30.16	+ .11	50.4	+ 7.8	76	19	58	24	1	43	27	....	....	....	3.24	— 1.7	17	7,549	ne.	40	nw.	23	4	9	18	7.3	0.2
Louisville	525	114	136	29.59	30.18	+ .13	51.7	+ 7.3	80	18	60	26	2	43	30	47	43	78	3.18	— 0.8	12	5,775	n.	48	w.	23	5	8	18	7.0	T.
Evansville	431	72	82	29.67	30.15	+ .11	51.0	.....	77	19	58	22	1	44	32	....	....	....	4.66	.....	14	4,854	ne.	33	w.	23	3	14	14	7.1	0.6
Indianapolis	822	154	164	29.27	30.18	+ .14	47.2	+ 7.7	76	18	55	19	1	39	30	44	41	85	2.13	— 1.5	12	7,385	ne.	50	sw.	23	2	19	10	6.5	1.3
Cincinnati	628	152	157	29.49	30.18	+ .13	49.7	+ 7.5	77	19	58	24	1	42	26	46	42	79	4.97	+ 1.7	12	4,947	ne.	36	w.	23	3	10	18	7.7	T.
Columbus	824	87	100	29.28	30.17	+ .13	47.8	+ 9.7	77	19	56	23	1	39	26	43	40	80	4.13	+ 1.2	10	8,454	sw.	51	w.	23	3	11	17	7.4	T.
Pittsburg	842	116	123	29.27	30.19	+ .15	50.1	+11.4	78	20	58	25	2	42	26	44	40	75	4.29	+ 1.6	13	4,277	nw.	29	nw.	20	7	9	15	6.5	T.
Parkersburg	638	77	84	29.49	30.19	+ .14	51.7	+10.3	81	20	61	26	8	43	33	45	41	76	5.35	+ 1.7	13	4,090	s.	39	nw.	20	5	11	15	6.8	T.
Elkins	1,940	41	50	28.11	30.18	+ .13	48.6	.....	77	19	59	16	2	38	40	43	39	79	3.64	.....	13	3,215	n.	29	se.	30	2	15	14	7.0	0.6
Lower Lake Region.							**42.1**	**+ 9.8**									**83**	**2.72**	**+ 0.2**									**6.0**	
Buffalo	767	178	206	29.34	30.19	+ .17	41.4	+11.4	74	20	48	19	1	35	26	38	36	85	3.32	+ 0.8	17	10,084	sw.	56	w.	1	2	13	16	7.5	0.5
Oswego	335	76	91	29.81	30.19	+ .18	40.4	+10.0	76	20	47	18	1	34	33	38	35	86	4.82	+ 2.2	12	7,794	s.	35	nw.	25	10	4	17	6.4	3.1
Rochester	523	81	90	29.61	30.20	+ .18	42.4	+12.1	79	20	50	18	1	35	32	38	35	82	3.88	+ 1.0	14	6,538	w.	36	sw.	1	5	8	18	7.3	2.4
Syracuse	597	97	113	29.54	30.19	+ .17	42.1	.....	76	19	50	18	1	35	33	....	....	....	4.65	.....	15	8,683	nw.	56	s.	7	4	10	17	7.0	1.5
Erie	713	92	102	29.39	30.18	+ .16	42.0	+ 9.6	77	19	49	18	1	35	37	38	36	83	2.82	+ 0.1	14	7,259	w.	41	s.	7	11	6	14	6.1	0.3
Cleveland	762	190	201	29.34	30.18	+ .15	43.6	+10.1	76	19	51	22	2	36	24	40	37	82	2.10	— 0.7	16	9,711	se.	48	sw.	20	5	12	14	6.5	0.8
Sandusky	629	62	70	29.49	30.19	+ .16	42.6	+ 7.9	77	19	50	22	1	36	28	....	....	....	1.77	— 0.8	13	5,638	sw.	32	nw.	25	8	10	13	6.0	0.1
Toledo	628	123	127	29.48	30.17	+ .14	42.8	+ 8.2	76	19	51	21	1	35	36	38	35	80	1.67	— 0.4	11	7,620	ne.	42	sw.	24	6	15	10	6.0	0.3
Detroit	730	153	193	29.36	30.17	+ .14	41.4	+ 8.9	73	19	49	19	1	34	30	38	36	85	1.36	— 0.9	12	8,650	sw.	50	sw.	24	6	9	16	6.7	0.1
Upper Lake Region.							**35.6**	**+ 9.0**									**82**	**2.33**	**+ 0.3**									**6.5**	
Alpena	609	63	80	29.48	30.15	+ .12	35.8	+11.8	73	19	43	7	1	29	32	32	29	84	1.51	— 0.4	8	7,803	se.	38	s.	24	8	8	15	6.1	1.4
Escanaba	612	43	57	29.45	30.14	+ .10	31.6	+ 9.8	46	26	38	6	1	26	23	30	28	89	2.70	+ 0.9	10	5,857	n.	31	s.	24	7	8	16	6.3	1.5
Grand Haven	632	54	92	29.44	30.14	+ .11	39.2	+ 8.6	71	19	46	16	1	32	34	36	34	86	1.64	— 0.6	11	9,176	s.	49	s.	24	8	10	13	6.3	2.2
Houghton	668	66	74	29.37	30.12	+ .08	30.8	.....	56	12	38	5	6	24	34	....	....	....	3.27	.....	13	4,476	w.	35	n.	24	9	6	16	6.9	11.0
Marquette	734	79	116	29.31	30.14	+ .10	31.9	+ 8.7	56	30	37	8	1	27	22	29	25	78	2.44	+ 0.6	13	6,964	nw.	50	sw.	30	4	9	18	7.2	10.8
Port Huron	638	70	120	29.48	30.19	+ .16	39.6	+10.5	74	19	47	18	1	32	33	36	33	84	1.54	— 1.1	7	8,547	sw.	45	sw.	24	5	9	17	7.1	0.1
Sault Ste. Marie	614	40	61	29.43	30.12	+ .09	31.1	+ 9.2	50	19	37	— 1	1	25	27	28	25	80	3.01	+ 1.8	13	6,459	se.	38	w.	25	9	9	13	6.1	2.6
Chicago	823	241	274	29.25	30.16	+ .13	40.4	+ 6.3	74	18	48	13	1	33	32	37	35	85	1.67	— 0.8	11	12,622	sw.	52	sw.	24	12	5	14	5.7	0.7
Milwaukee	681	124	142	29.39	30.16	+ .13	39.6	+ 9.1	75	18	47	11	1	32	39	35	32	82	3.20	+ 0.7	12	7,873	sw.	44	sw.	24	8	10	13	6.2	2.5
Green Bay	617	49	57	29.44	30.12	+ .08	36.6	+ 9.9	72	18	44	6	1	29	39	33	29	79	3.75	+ 1.6	14	7,904	ne.	38	nw.	24	4	6	21	7.1	1.7
Duluth	702	95	116	29.33	30.12	+ .06	30.2	+ 6.2	57	30	37	— 1	1	24	32	27	23	75	1.87	+ 0.2	13	7,398	ne.	32	ne.	19	9	9	13	6.3	3.1

TABLE I.—*Climatological data for Weather Bureau Stations, March, 1903*—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.									Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
North Dakota.							**23.2**	+ **1.1**										**76**	**0.35**	− **0.5**								**5.6**	
Moorhead	935	54	60	29.08	30.14	+ .06	26.0	+ 5.8	51	31	34	3	21	18	26	24	23	91	0.85	− 0.0	6	8,547	nw.	46	se.	29	7	9	15	6.5	6.7
Bismarck	1,674	16	29	28.30	30.16	+ .10	25.2	+ 2.6	67	29	36	− 4	20	14	39	21	14	64	0.12	− 1.0	4	8,287	n.	35	n.	19	12	9	10	5.1	1.2
Williston	1,885	14	44	28.04	30.10	+ .06	18.5	− 5.0	62	31	29	−19	20	8	49	17	12	73	0.09	− 0.4	4	7,332	n.	42	w.	21	11	10	10	5.1	1.0
Upper Miss. Valley.							**42.3**	+ **6.5**										**78**	**2.30**	**0.0**								**6.0**	
Minneapolis	.....	99	208	.....	.....	.....	33.6	+ 6.2	60	31	40	8	1	27	28	.....	.....	.....	2.05	+ 0.5	7	8,212	nw.	38	nw.	24	8	8	15	.....	4.1
St. Paul	837	102	122	29.18	30.11	+ .06	34.0	+ 6.5	60	12	40	10	1	28	23	32	29	82	2.33	+ 0.9	7	6,069	nw.	30	nw.	24	9	6	16	6.4	3.7
La Crosse	714	71	87	29.34	30.14	+ .10	38.0	+ 7.2	71	18	45	6	1	31	31	.....	.....	.....	1.56	0.0	12	5,663	s.	25	nw.	24	9	8	14	5.7	1.5
Davenport	606	71	79	29.46	30.11	+ .08	42.6	+ 7.7	76	18	51	13	1	34	29	38	35	78	2.06	− 0.1	12	5,681	s.	32	w.	24	8	8	15	6.1	0.7
Des Moines	861	84	88	29.20	30.15	+ .11	40.6	+ 5.9	74	18	50	15	1	32	34	36	33	79	1.09	− 0.4	11	6,371	sw.	34	sw.	18	7	12	12	6.3	8.3
Dubuque	698	100	117	29.37	30.14	+ .10	39.6	+ 6.7	75	18	48	11	1	32	29	36	32	77	1.84	− 0.4	12	5,016	se.	26	sw.	24	7	4	20	7.2	2.6
Keokuk	614	63	78	29.46	30.13	+ .10	44.4	+ 6.8	77	18	53	15	1	36	30	40	36	79	3.03	+ 0.8	11	5,856	sw.	32	w.	24	11	11	9	5.2	0.2
Cairo	356	87	93	29.77	30.16	+ .12	52.0	+ 5.2	75	17	59	23	1	45	30	47	43	75	4.28	+ 0.5	11	6,184	ne.	29	w.	23	6	8	17	6.7	T.
Springfield, Ill	644	82	93	29.46	30.16	+ .13	45.4	+ 6.2	76	18	54	16	1	36	30	41	37	80	1.47	− 1.2	8	7,003	s.	28	s.	18	11	7	13	5.5	0.3
Hannibal	534	75	110	29.56	30.14	+ .12	46.0	+ 6.5	77	17	55	13	1	37	31	.....	.....	.....	2.37	− 0.3	10	6,578	sw.	31	nw.	24	10	8	13	5.9	T.
St. Louis	567	111	210	29.53	30.14	+ .11	49.4	+ 6.3	78	17	57	20	1	42	26	44	40	75	3.20	− 0.3	12	6,464	s.	37	sw.	19	10	8	13	5.5	0.3
Missouri Valley.							**38.9**	+ **3.5**										**77**	**1.53**	− **0.3**								**5.6**	
Columbia	784	11	84	29.28	30.13	+ .10	46.4	+ 5.0	79	17	56	15	1	36	40	.....	.....	.....	3.46	+ 0.4	13	6,081	se.	30	w.	23	11	6	14	5.9	0.8
Kansas City	963	78	95	29.11	30.16	+ .14	45.4	+ 4.9	76	17	55	17	1	36	37	40	35	74	1.92	− 0.3	7	5,833	se.	24	nw.	20	10	10	11	5.5	3.0
Springfield, Mo	1,324	98	104	28.70	30.12	+ .10	48.0	+ 4.5	74	17	57	17	1	39	31	43	39	78	2.82	− 0.9	11	7,445	se.	33	w.	23	14	7	10	4.6	0.2
Topeka	.....	81	89	.....	.....	.....	44.0	+ 3.0	76	31	55	15	1	33	36	.....	.....	.....	1.27	− 0.9	5	6,802	s.	29	s.	18	7	13	11	5.9	1.2
Lincoln	1,189	75	84	28.82	30.12	+ .10	39.1	+ 1.2	74	17	49	12	1	30	35	35	30	76	0.47	− 0.9	6	8,558	n.	32	nw.	20	10	7	14	5.7	2.1
Omaha	1,105	115	121	28.92	30.13	+ .09	39.6	+ 4.1	74	17	48	14	1	31	36	35	31	77	0.58	− 0.9	7	6,924	s.	28	nw.	23	10	7	14	6.0	2.3
Valentine	2,598	47	54	27.28	30.08	+ .05	32.3	+ 1.1	75	31	44	1	1	21	47	28	24	79	0.28	− 1.2	5	8,919	nw.	41	sw.	29	14	8	9	4.7	1.3
Sioux City	1,135	96	164	28.88	30.13	+ .08	36.0	+ 4.4	67	12	45	11	20	27	36	.....	.....	.....	1.85	+ 0.6	8	9,613	nw.	41	nw.	23	8	8	15	6.2	0.3
Pierre	1,572	43	50	28.40	30.12	+ .07	31.8	+ 2.4	72	29	41	4	20	22	38	27	23	75	1.03	+ 0.2	6	6,802	se.	42	n.	19	10	9	12	5.6	5.7
Huron	1,306	56	67	28.69	31.13	+ .07	30.4	+ 2.8	65	11	40	3	20	21	38	26	23	80	1.02	+ 0.1	5	9,723	se.	47	se.	29	9	11	11	5.7	0.9
Yankton	1,233	42	49	28.78	30.14	+ .09	34.8	+ 4.8	71	12	44	10	20	26	37	.....	.....	.....	2.13	+ 1.0	6	6,152	nw.	28	se.	9	14	7	10	4.9	1.8
Northern Slope.							**29.7**	− **2.2**										**72**	**0.88**	**0.0**								**5.3**	
Havre	2,505	46	53	27.37	30.11	+ .11	19.8	− 9.2	56	10	31	−10	20	9	49	18	15	85	0.52	0.0	6	6,803	ne.	39	sw.	31	10	15	6	5.1	4.0
Miles City	2,371	42	50	27.47	30.06	+ .04	29.4	− 2.0	70	30	39	2	5	19	40	25	21	76	0.28	− 0.3	4	4,834	n.	32	nw.	21	10	12	9	5.6	2.8
Helena	4,110	88	94	25.74	30.05	+ .04	29.2	− 3.4	61	28	40	− 1	5	19	43	24	16	63	0.92	+ 0.3	8	5,545	sw.	33	w.	30	9	9	13	5.7	12.3
Kalispell	2,965	45	51	26.85	29.97	− .02	32.7	.....	58	24	41	6	5	24	32	28	22	65	0.53	.....	7	4,946	w.	32	sw.	8	11	14	6	4.6	0.2
Rapid City	3,234	46	50	26.60	30.08	+ .07	30.8	− 0.4	67	31	43	− 3	20	19	46	26	22	76	1.10	0.0	8	6,667	w.	36	se.	5	15	6	10	4.7	9.0
Cheyenne	6,088	56	64	23.94	30.06	+ .10	32.0	− 0.9	62	11	43	2	19	21	35	26	19	65	1.00	+ 0.3	8	7,186	w.	34	w.	6	7	10	14	6.3	9.5
Lander	5,372	26	36	24.57	30.05	+ .06	30.1	− 0.4	65	12	44	−13	20	16	43	24	17	64	2.25	+ 0.6	7	2,648	sw.	24	sw.	6	9	18	4	4.9	22.2
North Platte	2,821	43	52	27.11	30.11	+ .11	36.3	+ 1.2	75	12	47	5	1	26	42	31	28	80	0.12	− 0.6	3	6,778	s.	31	nw.	19	10	12	9	5.3	T.
Middle Slope.							**42.2**	+ **0.2**										**74**	**1.34**	**0.0**								**5.2**	
Denver	5,291	79	151	24.67	30.03	+ .08	37.9	− 0.9	72	12	49	10	20	26	37	31	24	67	0.87	− 0.1	4	5,228	s.	51	n.	18	10	11	10	5.3	9.9
Pueblo	4,685	80	86	25.25	30.00	+ .08	40.2	− 0.2	75	12	55	3	1	26	46	32	23	60	1.01	+ 0.5	8	4,747	se.	36	w.	21	9	14	8	5.3	6.9
Concordia	1,398	42	47	28.61	30.12	+ .11	41.0	+ 2.0	74	17	51	7	1	31	37	36	34	82	1.21	− 0.4	11	5,925	s.	28	s.	17	13	5	13	4.9	4.0
Dodge	2,509	44	54	27.44	30.10	+ .13	39.9	− 1.7	76	31	52	− 9	1	28	43	35	31	78	0.67	− 0.3	4	9,194	se.	50	s.	17	11	8	12	5.3	0.1
Wichita	1,358	78	86	28.67	30.13	+ .14	45.5	+ 2.0	76	31	56	12	1	35	31	41	37	80	1.61	− 0.3	7	6,704	s.	29	sw.	25	10	13	8	5.1	T.
Oklahoma	1,214	79	86	28.80	30.10	+ .12	48.9	− 0.2	77	31	59	18	1	39	33	43	39	75	2.68	+ 0.6	10	8,312	s.	38	n.	22	10	9	12	5.5	1.0
Southern Slope.							**47.6**	− **1.6**										**72**	**1.28**	+ **0.5**								**4.0**	
Abilene	1,738	45	54	28.25	30.07	+ .11	52.3	− 1.8	83	31	62	23	1	43	29	46	42	76	2.31	+ 1.1	4	5,365	se.	25	nw.	23	3	15	13	3.6	0.8
Amarillo	3,676	43	52	26.26	30.03	+ .08	43.4	− 1.5	81	31	56	− 2	1	30	41	36	29	67	0.26	− 0.1	4	10,258	s.	32	nw.	22	16	13	2	4.3	1.0
Southern Plateau.							**50.1**	− **1.1**										**40**	**1.00**	+ **0.1**								**4.1**	
El Paso	3,762	10	110	26.17	29.95	+ .07	54.4	− 1.4	82	31	68	25	1	41	42	40	24	38	0.15	− 0.2	3	8,226	nw.	42	w.	30	14	14	3	3.7	T.
Santa Fe	7,013	47	50	23.21	29.99	+ .10	39.2	− 0.3	64	31	50	4	1	29	33	30	19	49	1.32	+ 0.7	8	5,279	nw.	36	s.	17	20	7	4	3.2	1.0
Flagstaff	6,907	12	25	23.29	29.92	+ .01	35.7	− 1.5	58	12	47	10	2	25	40	31	.....	.....	3.77	+ 0.9	10	.....	sw.	.....	.....	.....	10	9	12	5.4	25.3
Phoenix	1,108	50	56	28.80	29.96	+ .05	59.8	− 1.1	86	29	74	36	18	46	39	47	32	42	0.42	− 0.2	5	3,279	e.	19	sw.	17	16	8	7	3.9	
Yuma	141	16	50	29.80	29.95	+ .01	63.2	− 0.8	90	28	77	38	8	49	41	49	34	38	T.	− 0.3	0	4,837	w.	30	w.	17	23	7	1	1.7	
Independence	3,910	51	58	25.91	29.91	− .03	48.1	− 1.6	71	29	59	26	7	38	31	36	16	32	0.34	− 0.1	3	6,732	s.	38	s.	13	5	10	16	6.8	0.1
Middle Plateau.							**40.6**	− **0.0**										**62**	**1.10**	− **0.1**								**5.7**	
Carson City	4,720	82	92	25.17	29.92	− .06	40.4	− 0.8	65	27	51	15	6	30	39	34	26	62	1.56	+ 0.2	5	6,075	sw.	37	sw.	28	10	10	11	5.3	5.2
Winnemucca	4,344	59	70	25.52	29.94	− .07	38.2	− 2.5	65	30	49	14	*	28	35	34	28	70	0.98	+ 0.1	12	6,464	ne.	52	sw.	30	8	7	16	5.9	5.3
Modena	5,479	10	38	24.55	29.95	− .01	37.6	.....	63	30	48	8	1	27	36	31	23	61	0.74	.....	7	6,836	sw.	41	sw.	5	9	12	10	5.2	3.5
Salt Lake City	4,366	105	110	25.56	29.97	− .01	42.3	+ 0.7	65	13	51	14	1	34	28	34	25	52	1.35	− 0.7	5	5,033	se.	29	nw.	18	5	9	17	6.8	9.6
Grand Junction	4,608	43	51	25.36	30.02	+ .08	41.7	− 1.1	66	31	52	7	2	31	32	35	29	63	0.73	− 0.1	8	4,192	se.	24	se.	31	7	15	9	5.4	1.5
Northern Plateau.							**40.9**	+ **0.4**										**66**	**1.10**	− **0.5**								**6.2**	
Baker City	3,471	53	58	26.35	29.97	− .06	36.4	+ 0.9	59	28	44	16	6	29	28	31	25	67	0.86	− 0.9	12	5,002	nw.	30	s.	11	7	6	18	6.9	3.7
Boise	2,739	61	68	27.11	29.99	− .04	43.2	− 0.7	68	30	52	18	9	34	30	37	29	60	0.83	− 1.0	10	4,571	se.	26	s.	30	8	8	15	6.5	2.9
Lewiston	757	52	61	29.16	29.99	− .04	45.0	+ 1.2	74	24	54	26	6	36	36	.....	.....	.....	0.88	+ 0.1	11	2,686	e.	33	nw.	28	8	8	15	6.3	4.0
Pocatello	4,482	46	54	25.41	29.99	− .02	37.8	+ 3.5	60	29	45	9	1	30	27	33	27	68	0.86	− 1.3	12	8,338	e.	34	se.	11	7	16	8	5.7	4.9
Spokane	1,943	101	110	27.90	29.97	− .04	39.0	− 0.7	66	24	48	18	5	30	34	33	26	62	1.22	− 0.2	11	5,742	s.	36	sw.	7	9	6	16	6.4	0.5
Walla Walla	1,000	65	73	28.89	29.97	− .05	44.0	− 1.5	73	24	52	21	4	36	32	42	39	84	1.92	+ 0.1	12	4,787	s.	35	s.	10	9	15	7	5.7	6.8
N. Pac. Coast Reg.							**43.0**	− **2.1**										**75**	**4.76**	− **0.4**								**6.1**	
North Head	211	11	56	29.72	29.95	− .06	43.8	− 1.6	60	22	48	31	12	39	15	41	39	84	4.93	− 1.5	15	11,157	nw.	90	s.	10	10	5	16	6.4	2.3
Port Crescent	259	13	20	29.70	.....	.....	38.4	− 3.2	54	23	45	21	12	32	22	.....	.....	.....	4.45	− 0.2	13	4,982	ne.	44	ne.	3	10	10	11	5.5	17.5
Seattle	123	114	151	29.85	29.97	− .02	42.5	− 2.3	66	23	50	28	13	36	30	38	33	73	6.10	+ 3.0	16	5,471	n.	34	se.	9	10	8	13	5.8	8.6
Tacoma	213	113	120	29.75	29.99	− .01	41.6	− 2.8	65	23	49	28	16	34	29	.....	.....	.....	5.83	+ 1.9	15	5,534	n.	30	sw.	9	4	9	18	7.3	9.7
Tatoosh Island	86	7	57	29.83	29.92	− .04	42.4	− 1.9	56	22	47	29	12	38	13	39	36	80	4.35	− 4.8	14	13,687	e.	66	sw.	9	12	5	14	5.4	7.6
Portland, Oreg	154	68	96	29.79	29.95	− .07	45.8	− 1.4	72	23	54	30	12	38	32	41	34	67	4.29	− 1.2	11	4,830	nw.	36	sw.	10	10	6	15	6.1	2.6
Roseburg	518	56	67	29.38	29.94	− .10	46.4	− 1.3	71	22	56	28	19	37	38	41	35	71	3.40	− 0.1	15	2,775	nw.	28	w.	28	7	8	16	6.4	0.7
Mid. Pac. Coast Reg.							**51.0**	− **1.4**										**78**	**5.47**	+ **1.5**								**6.9**	
Eureka	62	62	80	29.92	29.99	− .07	49.2	+ 0.5	67	27	55	34	9	43	20	45	41	76	7.42	+ 1.2	16	5,586	se.	33	nw.	8	4	11	16	6.6	
Mount Tamalpais	2,375	11	18	27.50	30.00	− .06	43.8	.....	63	22	48	31	5	39	17	40	37	82	6.77	.....	16	10,627	sw.	52	nw.	8	3	15	13	7.1	3.1
Red Bluff	332	50	56	29.63	29.99	− .05	50.0	− 4.5	70	23	58	32	9	42	31	46	42	78	4.99	+ 1.7	16	4,545	se.	31	se.	28	5	15	11	6.4	
Sacramento	69	106	117	29.92	30.00	− .03	52.2	− 2.5	69	23	59	38	18	46	23	47	43	75	4.81	+ 1.9	14	5,735	se.	38	se.	28	4	10	17	7.1	
San Francisco	155	161	167	29.86	30.04	− .02	52.2	− 1.4	64	22	57	41	16	48	17	48	45	78	6.23	+ 3.2	16	5,820	w.	33	w.	8	6	10	15	6.6	
Point Reyes Light	490	7	50	29.43	29.95	.....	51.2	+ 1.1	63	20	56	40	5	47	15	.....	.....	.....	3.88	− 0.6	12	12,905	nw.	64	nw.	8	2	12	17	7.4	
S. Pac. Coast Reg.							**55.5**	**0.0**										**74**	**3.84**	+ **1.6**								**5.4**	
Fresno	330	67	70	29.64	30.01	.00	54.8	+ 0.3	74	22	64	35	6	46	31	49	44	71	2.28	+ 1.0	15	3,329	nw.	23	s.	31	10	7	14	5.7	
Los Angeles	338	116	123	29.66	30.04	+ .02	56.2	− 0.1	75	11	65	40	6	47	30	50	44	72	6.93	+ 4.0	13	3,669	ne.	20	w.	17	9	8	14	5.8	
San Diego	87	94	102	29.92	30.02	.00	57.6	+ 1.6	72	21	64	42	18	51	25	52	47	74	1.17	− 0.4	7	4,551	nw.	31	s.	25	17	7	7	4.3	
San Luis Obispo	201	46	48	29.84	30.06	.00	53.5	− 1.7	76	21	63	35	1	44	36	48	44	77	4.98	+ 2.0	14	3,323	w.	20	s.	31	7	12	12	5.9	
West Indies.																														
Bridgetown	30	57	65	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Grand Turk	11	6	20	30.02	30.04	+ .02	77.0	.....	88	30	84	63	12	70	21	.....	.....	.....	0.85	.....	12	.....	e.	.....	.....	.....	24	7	0	3.5	
Havana	57	87	105	29.96	30.02	+ .01	74.2	+ 1.0	85	23	81	61	13	67	20	.....	.....	.....	5.12	+ 3.3	15	8,574	e.	44	n.	15	11	16	4	4.8	
San Juan	82	48	90	29.90	30.00	− .02	75.6	.....	84	27	81	65	12	70	14	70	68	77	4.26	+ 1.9	18	8,334	e.	36	e.	23	15	16	0	3.8	

NOTE.—The data at stations having no departures are not used in computing the district averages. *More than one date.

TABLE II.—*Climatological record of voluntary and other cooperating observers, March, 1903.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Anniston	77	39	57.2	6.03	
Ashville	76	33	58.0	5.18	
Benton				4.97	
Bermuda	85	32	63.0	3.90	
Birmingham	79	35	60.6	5.74	
Bridgeport				7.25	
Burkeville				3.81	
Calera				6.18	
Camphill	82	33	60.0	6.08	
Citronelle	79	39	63.0	7.63	
Clanton	78	40	58.7		
Cordova	82	28	60.1	3.57	
Daphne	79	42	63.4	7.56	
Decatur	79	35	59.2	4.53	
Demopolis				4.82	
Dothan	85	42	64.2	5.72	
Eufaula	82	35	61.8	6.79	
Eutaw	85[e]	35[e]	61.0[e]	3.94	
Evergreen	82	39	63.0	4.75	
Flomaton	84	32	63.1	4.72	
Florence *a*				6.24	
Florence *b*	79	29	57.2	6.29	
Fort Deposit	83	38	60.6	4.29	
Gadsden	80	34	58.2	6.96	
Goodwater	81	32	58.6	6.87	
Greensboro	78			4.22	
Greenville				3.62	
Haleysville	78	29	57.5	4.65	
Hamilton	76[4]	27	57.3	5.99	
Helena				6.56	
Highland Home	83	35	61.5	5.29	
Letohatchie				4.30	
Livingston	79	34	59.9	3.93	
Lock No. 4	79	32	58.1	5.76	
Madison Station	77	34	58.7	4.87	
Maplegrove	78	31	56.8	8.83	
Marion	79	35	59.2	5.68	
Milstead				4.82	
Newbern	82	35	61.0	5.07	
Notasulga				4.83	
Oneonto	76	28	57.2	5.46	
Opelika	80	32	59.8	7.38	
Ozark	82	40	62.6	6.68	
Prattville	85	31	60.6	3.84	
Pushmataha	79	31	60.5	7.56	
Riverton	81	26	55.7	6.28	
Scottsboro	78	30	56.0	6.50	
Selma	80	38	60.0	4.58	
Talladega	80	31	58.8	7.04	
Tallassee				4.58	
Thomasville	80	35	60.8	7.70	
Tuscaloosa	80	33	59.0	4.51	
Tuscumbia	76	32	56.4	7.81	
Tuskegee	82	36	62.7	5.60	
Union Springs	82	38	61.6	8.35	
Uniontown	80	33	60.3	5.59	
Valleyhead	76	30	56.8	6.27	
Verbena				5.37	
Wetumpka	83	35	62.0	5.09	
Arizona.					
Agua Caliente	95	29	61.6	0.02	
Allaire Ranch				1.32	
Arizona Canal Co's Dam	84	35	59.0	0.50	
Ashfork	80	11	43.0	1.00	
Aztec	92	31	62.4	T.	
Bisbee	78	30	52.4	1.71	
Bowie	80	26	53.5	0.07	
Buckeye	88	30	56.6	0.40	
Champie Camp	91	26	58.0	0.21	
Cochise[o1]	95	28	56.4	1.05	
Congress	79	36	56.9	0.68	
Dudleyville	85	26	55.4	0.90	
Duncan	88	10	49.2	1.07	
Fort Apache	74	17	43.7	2.05	1.0
Fort Defiance	61	3	35.0	1.85	2.0
Fort Grant	77	32	54.4	2.05	
Fort Huachuca	76	31	55.4	1.47	
Jerome	70	31	50.2	0.93	
Maricopa	87	32	58.8	0.30	
Mesa	88	33	59.9	0.51	
Mesa (near)	88	30	57.5	0.59	
Mount Huachuca	79	26	53.1	2.56	
Mohawk Summit[o1]	91	50	63.8		
Natural Bridge				2.22	
Nogales	81	23	53.0	0.98	
Oracle	74	32	52.3	1.66	
Oro				1.05	
Parker	94	26	61.8	0.06	
Phoenix	89	31	58.4	0.76	
Pima	83	25	53.4	0.85	T.
Pinal Ranch				2.39	
Prescott	70	13	42.7	3.18	T.
San Simon	82	21	52.1	1.30	
Sentinel[o5]	90	50	68.1		
Showlow				2.18	2.0
Signal	90	25	57.2	0.33	
Superstition				1.11	
Taylor	73	12	44.5	0.75	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Arizona—Cont'd.	°	°	°	*Ins.*	*Ins.*
Tonto	79	26	53.8	1.35	
Tuba	74	15	48.1	0.44	
Tucson	82	24	55.1	1.63	
Vail[o5]	82	44	63.3	0.17	
Walnut Grove				2.06	
Yarnell				1.31	
Arkansas.					
Alco	78	24	53.5	5.12	2.0
Amity	81	26	56.5	7.09	T.
Arkadelphia	80	27	57.8	5.33	
Arkansas City				5.24	
Batesville	81	24	54.2	6.04	0.2
Beebranch	78	22	54.7	5.80	2.0
Blanchard	81	30	58.4	4.44	
Brinkley	77	29	56.4	4.42	
Camden *a*				7.19	
Camden *b*		30		7.18	
Conway	80	24	55.5	5.57	1.0
Corning	79	25	51.9	4.76	
Dallas	79	22	56.4	7.12	0.5
Dardanelle				6.50	
Dodd City	78			4.45	2.5
Dutton	72[4]	14[4]	50.2[4]	6.68	2.5
Eureka Springs	78	16	50.4	3.71	
Fayetteville	77	26	50.1	4.65	T.
Forrest City	79	28	56.0	4.07	
Fulton				4.64	
Hardy	80	20	51.8	6.82	2.0
Helena *a*				5.84	
Helena *b*	81	29	58.6	6.26	
Jonesboro	80	25	55.2	5.54	
Lacrosse	77	20	51.6		1.0
Lake Village	80	32	58.8	4.71	
Lonoke	82	28	57.2	4.58	
Lutherville	77	23	52.6	4.67	2.0
Malvern	84	26	56.1	5.00	
Marianna	77	28	56.1	7.23	
Marvell	80	29	57.3	5.93	
Mossville	73	14	49.4	8.37	3.3
Mountain Home	80	25	53.2	5.12	3.0
Mount Nebo	73	18	50.4	6.12	1.0
New Gascony	80			4.60	
Newport *a*				6.17	
Newport *b*	81	28	54.6	5.12	
Newport *c*	80	26	55.0	5.51	
Oregon	78	14	49.6	4.63	2.0
Ozark	85	20	55.4	5.59	2.0
Paragould	79	26	52.3	7.03	
Perry	78	26	55.6	6.13	1.5
Pinebluff	80	30	55.3	4.98	
Pocahontas	80	22	52.6	5.83	T.
Pond	78	11	49.6	3.29	0.5
Prescott	80	31	59.7	5.28	
Princeton	82	27	57.0	5.02	
Rison	80	26	54.8		
Rosadale	81	26	57.4	6.63	T.
Russellville	78	24	55.2	4.06	T.
Silversprings	77	15	50.6	3.39	0.5
Spielerville	81	22	55.2	4.37	1.0
Stuttgart	80	28	57.1	6.24	
Texarkana	82	29	58.4		
Warren	80	29	56.8	5.51	
Washington	80	28	57.8	8.10	
Wiggs	80	24	55.4	6.02	
Winchester	80	31	56.6	5.29	
Winslow	76	14	49.8	7.30	3.0
Witts Springs	74	17	50.7	5.70	
California.					
Angiola	78	28	53.4	0.90	
Azusa	81	37	58.0	9.00	
Bagdad	86	33	62.0	2.20	
Bakersfield	80	30	54.8	0.82	
Ballast Point L. H				1.20	
Barstow	82	21	51.6	1.00	
Berkeley	65	36	50.8	7.81	
Bishop	74	16	44.5	0.35	
Boca[o1]	56	— 2	31.6	0.90	9.0
Bodie	47	—21	21.0	0.78	8.0
Bowman	62	6	34.6	17.32	88.5
Branscomb	68	25	44.3	9.53	3.5
Caliente[o1]	69	36	49.4	1.92	
Campbell	70	32	51.4	6.22	
Campo				2.30	
Cape Mendocino L. H				7.30	
Cedarville	63	9	37.8	1.05	11.0
Chico	76	28	51.0	6.23	
Cisco[o1]	42	12	30.8	10.60	76.0
Claremont	83	28	52.9	8.59	
Cloverdale	72	30	50.0	7.05	
Colusa	70	34	51.0	4.91	
Corning[o1]	75	36	50.6	5.23	
Coronado	77	44	59.4	1.25	
Crescent City	67	32	47.9	10.06	
Crescent City L. H				9.95	
Cuyamaca	61	21	39.2	6.13	
Delano[o1]	75	42	56.9	1.38	
Delta[o1]	79	28	45.0	14.74	3.6
Drytown	70	30	51.1	9.03	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Dunnigan[o1]	73	36	53.2	5.00	
Durham[o5]	71	33	51.3	6.19	
East Brother L. H				7.15	
Elcajon	81	34	55.6	1.33	
Elmdale	72	31	53.1	4.91	
Elsinore	83	28	54.2	6.55	
Escondido	79	25	54.0	2.78	
Fallbrook	76	34	55.0	5.19	
Folsom[o1]	75	37	53.6	9.27	
Fordyce Dam				18.37	106.0
Fort Bragg				5.37	
Fort Ross	65	32	50.0	12.87	
Foster				4.11	
Georgetown	66	25	44.6	16.60	14.0
Gilroy (near)	73	29	52.0	5.56	
Glendora				11.57	
Greenville	67	15	40.9	7.36	14.0
Hanford	77	30	54.2	1.71	
Healdsburg	72	30	50.1	7.60	
Hollister	71	30	52.5	4.30	
Humboldt L. H				8.85	
Idylwild	67	19	38.7	6.76	T.
Imperial	104	38	69.2	0.03	
Indio[o1]	90	45	64.9		
Iowa Hill[o1]	67	30	45.3	12.00	4.8
Irvine	78	36	57.6	4.98	
Jackson	68	31	48.1	11.84	T.
Jamestown	71	27	49.4	10.77	
Jolon				5.45	
Kennedy Gold Mine	64	25	44.7	16.72	
Kent	68	31	50.0	12.39	
Lakeport (near)	66	34	47.8	4.20	
Lamesa				2.10	
Laporte[o1]	58	15	34.0	16.71	69.5
Legrand	73	33	53.5	4.51	
Lemoncove	78	36	56.2	4.04	
Lick Observatory	55	26	39.8	9.89	
Lime Point L. H				5.21	
Livermore	75	31	52.9	5.65	
Lodi	72	32	52.4	10.31	
Los Gatos	68	35	51.0	10.17	
Lowe Observatory				12.90	
Manzana	77	26	50.4	3.02	
Mare Island L. H				5.27	
Merced	75	25	52.0	6.41	
Mercury	72	32	53.7	8.79	
Mills College				6.68	
Milo				5.08	
Milton (near)	69	36	52.7	8.08	
Modesto[o1]	76	38	57.2	5.16	
Mohave[o1]	75	25	49.0	0.35	
Mokelumne Hill				10.50	
Montague	72	18	42.6	1.81	
Monterio	74	28	48.5	3.08	
Monterey[o1]	67	33	55.0	5.98	
Mount St. Helena				10.61	4.0
Napa	72	35	51.1	4.99	
Needles	88	39	64.7	0.65	
Nevada City	68	24	43.2	13.80	9.5
Newcastle	75	35	51.6	10.00	
Newman	72	30	52.4	4.31	
Niles	72	36	52.8	5.82	
North Bloomfield	68	21	42.2	15.04	27.0
North San Juan	76	28	49.0	13.70	1.2
Oakland	70	38	53.2	7.42	
Ontario	78	33	55.3	7.24	
Orland	72	33	49.7	4.20	
Palermo	74	39	50.8	6.55	
Paso Robles	70	24	48.6	4.16	
Peachland	68	34	51.0	9.98	
Piedras Blancas L. H				7.16	
Pigeon Point L. H				5.85	
Pilot Creek				19.39	62.0
Pine Crest	70	35	53.4	6.83	
Placerville	66	26	46.2	11.85	
Point Ano Nuevo L. H				7.94	
Point Arena L. H				6.59	
Point Bonita L. H				6.74	
Point Conception L. H				5.31	
Point Fermin L. H				3.13	
Point George L. H				4.11	
Point Hueneme L. H				5.55	
Point Lobos	65	41	51.8	5.72	
Point Loma L. H				0.29	
Point Montara L. H				7.45	
Point Pinos L. H				6.56	
Point Sur L. H				4.34	
Porterville	78	31	54.7	1.85	
Poway				2.96	
Quincy	60	18	40.8	7.45	17.0
Redding	71	31	49.6	9.60	
Redlands	86	35	54.5	5.86	
Reedley	76	32	53.8	2.58	
Represa	80	36	54.6	8.13	
Riovista	70	32	51.8	4.35	
Riverside	80	25	54.0	5.22	
Roe Island L. H				4.74	
Rohnerville				7.21	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Rosewood	72	27	47.8	4.83	T.
Sacramento	72	33	52.8	5.78	
Salinas	77	32	53.8	3.02	
Salton *1	97	39	66.0	0.27	
San Bernardino	81	26	54.6	6.47	
San Jacinto	78	30	53.1	4.54	
San Jose	76	34	54.0	4.99	
San Leandro	71	34	52.6	6.61	
San Luis L. H.				5.90	
San Mateo *1	73	40	53.2	6.83	
San Miguel *1	74	31	51.7	2.96	
San Miguel Island	65	41	53.0	3.99	
Santa Barbara	72	38	54.6	6.12	
Santa Barbara L. H				4.76	
Santa Clara				4.52	
Santa Clara College	74	32	52.7	5.74	
Santa Cruz	73	31	51.2	11.06	
Santa Cruz L. H.				9.61	
Santa Maria	76	34	55.3	3.97	
Santa Monica	70	35	52.6	6.55	
Santa Paula	80	35	55.5	6.14	
Santa Rosa	70	29	49.1	6.49	
Shasta	75	30	49.7	14.03	
Sierra Madre	75	35	54.5	9.24	
Sisson	69	11	39.2	8.57	14.0
Snedden				3.45	
Sonoma				5.49	
S. E. Farallone L. H				3.26	
Stockton	67	33	51.4	7.29	
Storey	72	30	51.4	2.49	
Summerdale	60	14	37.6	11.83	43.0
Susanville	61	10	37.1	2.45	14.0
Tehama *1	70	36	53.0	6.34	
Tejon Ranch	76	37	53.8	1.86	
Trimmer				6.71	
Trinidad L. H				8.09	
Truckee *1	58	12	31.8	4.15	4.0
Tulare *b*				1.92	
Tulare *c*	80	32	55.4	1.88	
Tustin	74	44	60.9	5.73	
Ukiah	73	27	48.7	5.20	
Upland	74	32	52.2	9.45	
Upperlake	72	26	46.5	4.90	
Upper Mattole *1	76	31	49.2	15.65	
Vacaville *1	71	35	51.6	6.26	
Ventura	75	38	56.4	5.25	
Visalia	76	23	52.6	2.17	
Volcano Springs *1	93	45	73.1	0.00	
Wasco	77	30	53.8	0.60	
Westley	74	39	52.1	5.10	
West Saticoy				2.75	
Wheatland	69	31	50.4	6.81	
Williams *1	71	39	55.4	3.62	
Willits	68	30	46.8	7.56	
Willow	70	32	50.1	5.76	
Yerba Buena L. H.				5.80	
Yuba City *5	72	35	54.2	5.87	
Zenia	68	24	43.8	9.62	3.0
Colorado.					
Alford	64	— 3	32.4	0.76	10.8
Ashcroft	53	—16	24.2	0.85	12.0
Blaine	81	—10	40.6	0.23	2.2
Boulder	68	7	37.1	1.45	13.5
Boxelder				0.90	6.0
Buenavista				0.05	1.0
Canyon	74	1	40.4	0.36	3.0
Castlerock	70	— 2	36.4	0.70	7.8
Cedaredge	67	— 2	39.0	1.67	5.0
Cheesman	64	—15	33.7	0.40	4.5
Cheyenne Wells	72	— 2	36.2	0.23	3.0
Clearview	56	—18	28.9	0.83	13.5
Colorado Springs	66	— 2	36.7	0.37	4.0
Collbran	61	—10	35.0	1.32	5.0
Durango	61	4	37.0	3.90	14.0
Fort Collins	66	—10	30.6	1.03	8.0
Fort Morgan	72	— 3	35.0	0.27	3.0
Fox	74	— 2	36.1	0.10	2.0
Fruita	67	— 3	39.4	1.27	8.8
Garnett	58	—19	29.9	0.23	
Gilman				1.35	19.5
Gleneyre	71	—11	35.8	0.44	4.0
Glenwood	60	— 7	34.0	0.48	
Greeley	69	2	34.4	0.47	7.0
Gunnison	55	—29	23.6	0.90	6.7
Hamps	71	— 1	35.8	0.21	3.0
Hoehne	74	—17	39.0	0.12	0.5
Holyoke (near)	75	— 3	34.2	0.05	1.0
Husted	68	— 9	34.4	0.43	5.7
Lake Moraine	50	—16	25.8	1.46	14.5
Lamar	80	—13	40.4	0.20	2.0
Laporte				1.32	14.5
Las Animas	76	— 8	40.4	0.35	
Lay	56	—26	26.7	1.61	16.0
Leadville (near)				0.78	10.0
Leroy	69	0	34.0	0.26	2.0
Longs Peak	53	— 8	26.7	1.85	21.0
Mancos	59	— 3	34.4	2.96	26.8
Marshall Pass				0.90	14.0

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Colorado—Cont'd.	°	°	°	*Ins.*	*Ins.*
Meeker	58	—24	31.4	0.80	7.0
Montrose				1.20	10.0
Moraine	57	—11	30.9	1.06	13.0
Pagoda		—15		0.82	8.0
Parachute	64	1	38.8	0.79	7.0
Platte Canon				0.74	12.0
Rangely	61	—14	31.5	1.25	15.8
Rockyford	77	— 2	41.2	0.18	2.0
Rogers Mesa	63	— 5	37.2	1.26	2.2
Ruby				7.70	77.0
Russell	55	—22	26.1	1.40	10.0
Saguache	62	— 5	34.0	0.24	1.0
Salida	62	—18	36.2	0.57	1.0
San Luis	56	—27	31.0	0.50	4.0
Santa Clara	65	— 9	34.8	0.54	6.5
Sugarloaf	60	— 3	32.6	1.79	20.0
Telluride	54	—13	28.8	8.61	86.2
Trinidad	72	— 6	41.6	1.14	0.5
Twinlakes				0.37	4.0
Vilas				T.	T.
Wagon Wheel	50	—35	21.8	0.52	9.0
Wallet				0.50	5.0
Waterdale	62	— 3	32.3	0.93	7.0
Westcliffe	59	—14	31.4	2.03	29.0
Whitepine	44	—20	20.6	1.96	27.5
Wray	76	— 2	37.9	0.16	1.0
Yuma				0.20	
Connecticut.					
Bridgeport	68	20	45.4	6.07	
Canton	72	13	42.1	5.31	T.
Colchester	72	—19	45.1	7.93	T.
Falls Village				4.48	T.
Gaylordsville				5.04	
Hartford	71	21	44.5	6.87	T.
Hawleyville	70	19	45.5	5.16	
New London	67	22	43.6	4.39	0.2
North Grosvenor Dale	77	18	43.1	8.14	
Norwalk	67	16	44.4	5.83	
Southington	72	19	45.2	6.60	
South Manchester				6.13	
Storrs	70	16	43.1	7.09	
Voluntown	73	13	44.1	7.69	
Wallingford				6.50	
Waterbury	75	17	46.3	6.45	
West Cornwall	71	18	44.6	4.94	0.2
West Simsbury				5.13	
Delaware.					
Delaware City				4.62	
Milford	79	24	50.2	8.21	
Millsboro	74	23	50.6	8.06	
Newark	72	24	47.7	3.94	
Seaford	76	25	51.1	5.67	
District of Columbia.					
Distributing Reservoir *5	70	32	51.0	6.01	
Receiving Reservoir *5	68	28	50.6	6.02	
West Washington	76	22	50.6	6.69	
Florida.					
Archer	85	46	68.6	5.69	
Avon Park	85	55	71.4	5.85	
Bartow	90	54	74.2	6.42	
Bonifay	83	37	65.0	4.90	
Brooksville	88	49	71.0	6.03	
Carrabelle	78	44	65.6	1.16	
Clermont	90	53	72.0	4.83	
De Funiak Springs	84	37	64.6	7.04	
Deland	86	48	69.4		
Eustis	88	48	71.2	4.29	
Federal Point	86	51	68.4	3.53	
Fernandina	88	47	65.4	3.54	
Flamingo	84	57	73.7	4.20	
Fort George *1	76	52	65.6		
Fort Meade	89	48	71.0	8.61	
Fort Myers	82	58	71.3	7.78	
Fort Pierce	82	54	72.2	7.53	
Gainesville	86	48	69.0	6.68	
Grasmere	86	48	69.8		
Holt	81	35	63.6	4.55	
Huntington	89	50	70.0	4.98	
Hypoluxo	85	55	74.1	6.69	
Inverness	84	48	68.8	5.72	
Jasper	80	44	67.0	3.23	
Johnstown	85	45	67.6	1.90	
Kissimmee	85	52	70.2	5.84	
Lake City	84	44	68.0	3.28	
Macclenny	89	44	67.6	4.43	
Malabar	86	55	72.2	6.10	
Manatee	89	57	71.9	4.26	
Marco	87	54	74.4	7.80	
Marianna	83	41	65.0	4.63	
Merritt Island	82	58	71.2	5.39	
Miami	86	59	75.2	3.82	
Micanopy	90	49	69.4	4.21	
Middleburg	90	46	67.5	4.12	
Molino	84	35	64.1	7.66	
New Smyrna	83	54	67.4	5.78	
Nocatee	88	53	71.6	5.24	
Ocala	89	45	69.8	8.50	
Orange City	91	45	71.1	5.92	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Florida—Cont'd.	°	°	°	*Ins.*	*Ins.*
Orlando	89	52	71.6	8.37	
Pinemount	85	42	67.3	5.06	
Plant City	88	50	71.6	6.61	
Quincy	80	41	64.3	5.93	
Rockwell	86	45	69.2	8.36	
St. Andrews	83	38	65.6	2.63	
St. Augustine	84	50	66.8	3.23	
St. Leo	86	49	70.6	7.59	
Stephensville	89	39	67.4	3.93	
Sumner	87	41	68.8	4.86	
Switzerland	85	47	67.6	4.06	
Tallahassee	79	44	66.0	5.21	
Tarpon Springs	91	49	71.6	6.65	
Titusville	83	50	69.4	6.68	
Waukeenah	86	40	65.9	5.09	
Wausau	86	36	66.0	5.53	
Wewahitchka	82	45	65.8	4.28	
Georgia.					
Adairsville	76	32	57.4	11.39	
Albany	82	41	60.9	3.81	
Alpharetta	76	27	57.4	9.07	T.
Americus	80	38	61.7	5.16	
Athens	73	32	57.8	9.33	
Bainbridge	79	39	63.4	4.85	
Blakely				5.54	
Bowersville	79	30	56.8	6.70	
Brent	80	31	57.4	6.00	
Butler				4.84	
Camak	79	38	61.6	6.64	
Canton				5.00	
Carlton				7.69	
Clayton	71	25	54.3	14.81	
Columbus	82	38	63.7	5.84	
Coney	83	36	63.4	3.54	
Covington	79	30	58.6	6.66	
Dahlonega	72	28	54.8	9.95	
Dawson	83	38	63.6	3.90	
Diamond	77	27	56.0	10.83	
Douglas	84	38	65.4	7.07	
Dublin				7.77	
Dudley	82	37	62.7	7.99	
Eastman		38		6.49	
Eatonton	78	33	59.2	5.80	
Elberton	75	32	58.3	6.26	
Experiment	76	31	58.0	7.52	
Fitzgerald	87	39	64.4	5.18	
Fleming	84	37	63.8	5.67	
Fort Gaines	81	39	62.3	6.86	
Gainesville	71	31	55.4	12.17	
Gillsville	75	28	57.7	9.58	
Greensboro	79	30	59.2	4.81	
Griffin	78	31	58.3	8.12	
Harrison	83	35	62.2	6.28	
Hawkinsville	84	36	62.6	6.43	
Hephzibah	80	34	61.6		
Jesup	88	41	65.4	5.03	
Lost Mountain	75	29	57.6	8.49	
Louisville	85	37	62.6	6.11	
Lumpkin	83	36	62.2	5.66	
Marshallville	80	34	61.6	4.37	
Mauzy	84	40	66.0	5.90	
Milledgeville	79	34	60.6	5.98	
Millen				3.43	
Monticello	78	31	59.7	6.56	
Morgan	82			3.44	
Naylor	82	42	66.0	5.00	
Newnan	78	30	56.6	8.02	
Oakdale				6.87	
Point Peter	78	26	58.4	6.99	
Poulan	85	35	64.1	3.44	
Putnam	84	37	61.8	4.07	
Quitman	84	41	65.7	6.46	
Ramsey	75	27	57.8	7.42	
Resaca				7.84	
Rome	79	32	57.8	10.52	
St. Marys	82	45	65.6	3.37	
Statesboro	82	39	60.6		
Stillmore	83	34	61.5	6.51	
Talbotton	81	33	60.0	7.35	
Tallapoosa	77	27	56.4	5.95	
Thomasville	80	40	65.8	5.60	
Toccoa	73	29	56.0	12.11	
Valona	84	44	65.2	4.88	
Vidalia	83	39	63.9	6.94	
Washington				5.17	
Waverly	86	44	67.0	4.88	
Waycross	83	44	67.8	4.11	
Waynesboro	80	40	61.1	4.70	
Westpoint	82	33	60.0	7.74	
Woodbury	79	31	58.4	6.25	
Idaho.					
Albion	61	0	36.8	1.10	5.0
American Falls	64	— 3	36.8	1.13	
Blackfoot	66	— 3	36.3	0.52	0.6
Blue Lakes	73	8	42.7	1.72	1.0
Burnside	46	—10	26.2	2.00	13.0
Cambridge	60	— 4	32.6	2.46	8.3
Chesterfield	52	—27	26.0	0.48	2.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Idaho—Cont'd.	°	°	°	*Ins.*	*Ins.*
Dickey	48	−15	25.5	0.80	8.0
Forney	66	− 6	32.6	1.19	8.0
Garnet	79	21	45.6	0.86	4.0
Grangeville	64	14	36.8	4.29	24.1
Idaho City[1]	58	8	37.5	0.81	2.0
Lake	48	−18	25.4	2.40	24.0
Lakeview	63	15	37.2	2.82	5.0
Lost River	53	−10	26.2	1.02	8.0
Moscow	60	19	34.8	1.77	4.1
Murray	59	10	34.2	2.41	13.0
Oakley	63	7	37.0	2.00	3.0
Ola	64	3	38.2	2.38	9.5
Paris	48	.....	.....	1.70	17.0
Payette	68	18	42.8	0.88	8.0
Pollock	69	21	42.6	1.82	10.0
Porthill	57	7	33.1	2.66	8.5
Priest River	62	7	34.3	2.79	10.5
Riddle	60	− 8	31.0	2.50	24.0
Roosevelt	50	− 3	25.8	3.60	31.0
St. Maries	69	17	38.4	2.09	11.0
Silver City	54	7	31.2	2.13	14.0
Soldier	47	−22	24.6	1.80	17.0
Vernon	60	−11	29.6	1.53	5.8
Weston	64	−12	34.2	0.87	.....
Illinois.					
Albion	77	20	49.4	4.26	.....
Aledo	77	12	43.4	1.86	0.8
Alexander	77	21	46.1	2.67	0.8
Antioch	75	12	40.4	2.60	1.0
Ashton	75	10	40.4	3.14	2.2
Astoria	78	24	44.6	2.81	2.0
Aurora	76	12	41.2	3.94	2.1
Beardstown	.....	.....	.....	3.41	T.
Benton	80	20	51.2	4.01	T.
Bloomington	80	13	45.5	3.24	1.5
Cambridge	76	12	41.5	2.34	2.0
Carlinville	77	16	47.1	2.18	1.0
Carrollton	76	17	47.0	3.11	
Centralia	80	19	49.8	3.45	T.
Charleston	78	18	47.6	1.77	0.5
Chester	.....	.....	.....	4.33	
Chicago Heights	.....	.....	.....	2.34	.....
Cisne	80	20	50.0	3.34	T.
Coatsburg	78	13	45.2	2.54	T.
Cobden	77	20	50.5	5.87	T.
Danville	80[a]	17[a]	46.6[a]	2.22	T.
Decatur	78	15	45.9	2.48	1.0
Dixon	78	12[a]	39.8[a]	3.07	1.7
Dwight	79	13	42.5	2.50	1.0
Effingham	78	19	49.2	3.50	1.0
Equality	79	21	53.1	7.27	0.3
Fandon	77	14	45.3	2.42	0.2
Flora	75	19	47.9	3.57	1.0
Friendgrove	75	20	49.2	4.76	0.3
Galva	75	12	41.4	2.72	1.0
Grafton	.....	.....	.....	3.44	
Greenville	79	17	47.7	3.34	1.0
Griggsville	80	15	47.0	3.20	
Halfway	80	20	50.4	4.63	
Halliday	78	21	50.2	3.98	
Henry	78	13	44.4	3.84	1.5
Hillsboro	78	17	47.4	2.22	1.0
Hoopeston	77	14	44.8	0.64	1.0
Joliet	76	13	40.9	2.22	2.0
Kishwaukee	76	9	40.0	3.84	1.5
Knoxville	76	10	42.5	2.95	1.1
Lagrange	77	13	40.4	2.51	T.
Laharpe	78	15	44.2	1.92	T.
Lanark	72	20	46.5	2.94	1.2
La Salle	75	6	45.0	2.94	.....
Loami	.....	.....	.....	1.31	T.
McLeansboro	79	21	50.4	3.72	
Martinsville	77	30[f]	53.6[a]	.....	.....
Martinton	77	14	43.8	1.28	T.
Mascoutah	76	20	46.4	2.34	1.0
Mattoon	78	18	49.6	2.01	T.
Minonk	76	13	43.0	2.80	1.0
Monmouth	78	10	42.9	2.11	0.5
Monticello	79	23	47.9	0.95	T.
Morrison	75	12	41.6	2.41	2.0
Morrisonville	77	16	46.7	2.35	0.2
Mount Carmel	.....	.....	.....	4.44	1.0
Mount Pulaski	79	15	46.0	1.42	1.0
Mount Vernon	78	19	49.7	3.15	0.4
New Burnside	80	24	53.4	6.21	T.
Olney	77	19	48.8	3.66	2.1
Ottawa	78	15	44.8	3.10	0.8
Palestine	76	20	47.4	4.47	T.
Pana	78	12	44.6	2.84	0.5
Paris	76	19	46.8	2.73	
Peoria *a*	.....	.....	.....	4.48	T.
Peoria *b*	79	16	46.7	3.66	
Philo	75	17	45.2	1.45	
Plumhill	77	19	48.6	2.98	0.5
Pontiac	76	15	44.6	2.54	0.5
Rantoul	77	14	45.0	1.40	0.4
Raum	78	20	50.9	5.90	T.
Riley	74	10	40.0	3.47	1.5
Robinson	76	18	47.1	3.81	0.5
Rushville	77	10	45.6	2.45	T.
St. Charles	77	12	41.4	5.17	2.0
St. John	77	20	49.6	3.22	T.
Shobonier	78	18	48.0	3.47	T.
Streator	78	13	43.2	3.79	1.0
Sullivan	78	16	46.6	2.07	
Sycamore	79	11	41.9	3.10	T.
Tilden	78	19	49.0	3.06	0.5
Tiskilwa	75	12	42.0	2.71	0.1
Tuscola	78	16	45.9	1.71	T.
Urbana	76	15	44.2	1.43	0.5
Walnut	78	14	43.8	2.65	0.4
Winchester	77	18	46.2	4.45	
Winnebago	75	10	40.8	3.51	1.5
Yorkville	75	12	41.0	3.23	0.1
Zion	75	10	40.0	2.40	3.0
Indiana.					
Anderson	75	19	46.4	1.93	T.
Angola	76	16	42.1	1.81	1.1
Auburn	76[a]	17[a]	43.8[a]	1.08	
Avoca	81	15	48.4	4.32	0.5
Bloomington	76	20	48.2	4.75	T.
Bluffton	78	19	44.8	2.06	
Butlerville	76	22	48.4	5.03	T.
Cambridge City	78	20	44.6	2.86	1.0
Columbus	78	22	49.0	3.47	1.0
Connersville	78	21	46.4	4.32	
Crawfordsville	79	17	48.2	3.30	
Delphi	79	12	45.0	1.42	0.5
Edwardsville[a][1]	76	27	52.2	4.07	
Elkhart	77	16	43.6	1.18	
Elkhart	77	16	43.6	1.18	
Farmland	76	22	45.8	2.24	1.0
Fort Wayne	75	19	44.4	2.29	T.
Franklin[a][1]	78	23	48.4	3.10	0.5
Greencastle	75	17	46.5	2.17	0.6
Greensburg	77	21	47.0	4.53	T.
Hammond	76	23	41.0	1.42	
Hector	77	18	44.2	1.77	T.
Holland	80	22	50.8	4.08	0.5
Huntington	76	18	44.1	1.85	1.0
Jeffersonville	77	25	50.8	3.54	
Kokomo	78	18	44.6	1.35	0.1
Lafayette	76	16	46.4	1.53	T.
Laporte	.....	.....	.....	1.71	0.5
Logansport	80	18	45.2	1.29	
Madison *a*	80	23	51.0	4.58	T.
Madison *b*	.....	.....	.....	4.20	.....
Marengo	79	21	50.2	4.69	0.2
Marion	79	19	45.6	1.97	1.0
Markle	77	18	44.2	1.70	T.
Mauzy	76	20	46.2	3.29	1.0
Moores Hill	75	21	48.9	4.50	
Mount Vernon	78	24	49.4	4.47	T.
Northfield	75	16	44.6	1.77	T.
Paoli	79	21	49.6	3.95	1.0
Prairie Creek	75[e]	19	48.3	5.04	
Princeton	78	22	49.0	4.40	2.5
Rensselaer	75	15	44.5	1.30	T.
Richmond	79	21	47.6	3.06	T.
Rockville	76	17	47.4	2.24	T.
Salem	80	20	49.0	4.59	1.5
Scottsburg	78	24	50.2	6.71	T.
Seymour	77	23	49.2	4.00	0.5
South Bend	76	15	42.5	1.86	1.5
Syracuse	77	14	43.6	1.69	1.5
Terre Haute	75	20	46.4	2.72	T.
Topeka	75	22	44.8	1.92	
Valparaiso	77	15	41.6	1.82	
Veedersburg	76[a]	12[a]	48.0[a]	0.87	
Vevay	77	23	50.6	3.85	
Vincennes	79	21	49.6	4.49	1.0
Washington	78	22	47.1	4.65	1.0
Winamac	78	23	45.2	1.15	
Worthington	78	21	49.1	4.38	2.0
Indian Territory.					
Ardmore	82	21	52.8	2.41	2.7
Chickasha	81	18	49.7	2.97	
Durant	79	23	54.8	3.17	0.7
Fairland	78	18	50.2	2.63	T.
Goodwater	80	25	57.0	6.01	
Hartshorne[k]	82	20	55.2	4.71	
Healdton	78	20	51.2	2.08	1.0
Holdenville	78	20	53.2	2.79	
Marlow	80	20	49.8	1.42	
Muskogee	78	19	52.1	4.74	1.0
Ravia	78	23	53.2	2.21	0.7
South McAlester	.....	.....	.....	5.10	0.3
Tahlequah	83	18	52.8	4.24	2.2
Tulsa	.....	.....	.....	2.49	
Wagoner	80	25	49.8	2.72	
Webbers Falls	.....	.....	.....	5.32	
Iowa.					
Afton	74	12	40.0	0.78	4.0
Albia	76	13	42.6	1.87	
Algona	67	11	36.6	0.60	1.5
Allerton	75	13	41.9	1.85	2.0
Alta	65	9	35.4	0.80	0.7
Amana	73	11	40.7	1.44	2.0
Ames	73	13	38.4	0.61	2.4
Atlantic	73	15	38.8	1.11	3.5
Audubon	71	11	37.6	0.47	2.0
Baxter	78	6	39.4	0.90	9.0
Bedford	74	10	40.1	0.83	4.2
Belleplaine	76	11	39.2	2.10	11.8
Bonaparte	78	13	43.2	2.23	T.
Britt	71	13	36.0	0.73	1.1
Buckingham	.....	.....	.....	1.08	4.8
Burlington	79	13	44.8	2.32	.....
Carroll	71	11	38.5	0.70	1.0
Cedar Rapids	78	15	42.6	0.65	3.0
Chariton	75	13	41.3	0.86	4.8
Charles City	71	11	38.2	1.65	6.8
Clarinda	76	13	40.7	0.99	5.0
Clearlake	68	6	36.2	0.50	1.5
Clinton	78	14	41.1	2.36	2.0
College Springs	75	14	40.5	1.07	4.0
Columbus Junction	78	10	41.6	2.40	1.0
Corning	71	7	38.8	1.34	8.0
Corydon	75	12	41.9	1.97	5.0
Council Bluffs	76	7	36.3	0.50	2.6
Cumberland	.....	.....	.....	1.10	5.0
Danville	.....	.....	.....	1.55	.....
Decorah	70	7	37.1	1.58	6.5
Delaware	71	7	38.8	1.74	2.5
Denison	71	13	38.5	0.15	T.
Desoto	74	15	38.6	0.74	5.0
Dows	72	10	37.8	0.95	3.8
Earlham	74	12	39.6	1.05	6.5
Eldon	73	19	44.1	0.71	0.5
Elkader	76	10	39.4	2.07	8.0
Estherville	66	9	34.2	0.67	0.4
Fayette	72	7	36.5	1.70	5.0
Forest City	69	7	33.6	0.73	T.
Fort Madison	.....	.....	.....	2.25	.....
Galva	64	13	52.4	0.16	0.5
Gilman	.....	.....	.....	1.37	5.0
Grand Meadow	75	7	36.8	2.05	9.5
Greene	70	9	37.2	1.59	7.0
Greenfield	72	10	38.6	1.03	4.6
Grinnell	74	12	40.0	1.21	2.8
Grundy Center	72	9	38.5	1.91	11.5
Guthrie Center	73	13	38.8	0.95	4.5
Hampton	72	10	37.6	1.33	3.2
Hanlontown	70	9	36.0	0.73	0.5
Harlan	73	10	37.8	0.83	2.6
Hopeville	78[j]	16[k]	42.3[j]	1.14	.....
Humboldt	72	10	37.4	0.85	.....
Idagrove	67	10	38.4	1.96	0.6
Independence	72	10	37.4	0.80	4.6
Indianola	75	19	41.3	1.21	8.0
Iowa City	79	11	41.9	1.86	0.5
Iowa Falls	72	10	36.8	1.35	6.5
Jefferson	.....	.....	.....	1.40	3.5
Keosauqua	79	14	43.8	3.00	T.
Lacona	.....	.....	.....	2.49	7.0
Larchwood	70	8	34.6	2.11	T.
Larrabee	64	9	34.8	1.02	0.6
Leclaire	.....	.....	.....	2.61	0.2
Lemars	65	9	35.5	3.90	T.
Lenox	73	10	39.4	0.79	4.5
Leon	74	14	41.8	1.86	6.0
Logan	74	13	38.2	0.28	1.0
Maple Valley	.....	.....	.....	0.98	0.5
Maquoketa	76	11	41.0	1.83	.....
Marshalltown	74	12	40.4	1.55	8.5
Mason City	74	12	39.4	1.07	4.5
Mountayr	74	12	40.1	1.38	7.0
Mount Pleasant	82	10	44.1	1.15	T.
Mount Vernon	73	8	40.5	1.66	2.7
New Hampton	70	7	35.8	1.68	10.0
Northwood	66	9	36.3	0.95	3.0
Odebolt	77	11	38.9	0.54	0.5
Ogden	73	9	38.2	1.09	4.0
Olin	73	10	39.8	3.52	2.0
Onawa	69	13	38.4	1.08	2.0
Osage	67	8	36.0	2.02	6.5
Osceola	75	18	40.2	1.41	.....
Oskaloosa	73	12	41.2	0.90	3.5
Ottumwa	76	17	43.4	0.95	.....
Pacific Junction	73	13	39.4	0.58	2.3
Perry	72	14	39.3	0.80	3.0
Plover	68	8	35.9	0.50	1.0
Primghar	62	12	34.4	1.15	.....
Redoak	70	17	40.6	0.88	4.2
Ridgeway	70	7	38.1	2.81	10.0
Rockwell City	72	12	37.7	0.40	1.0
Ruthven	68	9	37.0	0.15	1.5
Sac City	69	10	36.8	0.57	1.0
St. Charles	74	14	41.0	1.92	7.7
Scranton	71	14	38.7	0.55	0.5
Sheldon	65	9	34.2	2.23	0.2
Sibley	63	10	30.8	2.52	0.2
Sigourney	78	11	42.6	1.35	1.0
Sioux Center	63	8	33.2	2.68	2.0
Stockport	.....	.....	.....	1.91	0.2

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Storm Lake	61	9	36.0	0.64	T.
Thurman	70	12	39.6	1.23	4.0
Tipton	75	11	41.6	1.57	2.0
Toledo	74	12	40.0	1.07	4.0
Vinton *1	72[e]	15	39.4	1.27	5.0
Wapello	75	17	42.6	1.38	0.5
Washington	77	9	40.6	2.25	.....
Washta	.....	.....	.....	0.90	.....
Waterloo	75	11	38.2	1.60	12.0
Waukee	.....	.....	.....	0.84	5.0
Waverly	73	9	37.3	1.59	8.5
Westbend	69	10	36.6	0.92	1.0
Westbranch	.....	.....	.....	1.99	0.8
Whitten	72	9	38.2	1.77	12.0
Wilton Junction	77	10	42.6	2.91	4.0
Winterset	74	20	42.9	0.66	.....
Woodburn	.....	.....	.....	1.19	8.5
Kansas.					
Achilles	75	— 6	37.2	0.77	6.4
Alton	78	— 6	41.2	0.59	T.
Anthony	.....	.....	.....	0.86	
Atchison	76	15	44.4	1.09	2.5
Baker	76	7	39.4	1.68	5.0
Beloit	76	1	41.6	0.33	.....
Burlington	78	13	46.0	2.03	1.0
Chanute	78	15	49.0	2.94	0.5
Clay Center	76	10	42.5	1.63	6.5
Colby	74	— 4	36.6	0.71	3.3
Columbus	78	14	47.9	5.87	0.1
Cottonwood	78	11	45.2	1.25	T.
Delphos	77	5	42.0	2.38	7.5
Dresden	73	— 8	37.5	0.62	3.0
Ellinwood	77	— 3	42.9	0.63	2.0
Emporia	77	17	45.8	1.91	0.7
Englewood	86	— 8	44.7	0.29	T.
Eureka	.....	.....	.....	2.26	T.
Eureka Ranch	78	— 6	39.8	0.57	1.5
Fall River	76	14	46.5	2.41	T.
Farnsworth	78	— 6	39.2	0.42	1.2
Forsha	76	4	44.6	1.10	
Fort Leavenworth	76	16	42.6	1.15	4.0
Fort Scott	78	15	48.2	4.77	T.
Frankfort	78	9	42.1	2.36	5.5
Fredonia	77	9	47.2	2.30	T.
Garden City	80	—10	40.1	0.70	2.0
Gove *1	73	1	36.9	0.21	0.8
Hanover	74	10[e]	41.4	0.60	3.0
Harrison	75	— 6	39.3	1.60	1.0
Holton	78	9	44.2	0.80	T.
Hoxie	76	— 2	36.9	0.45	3.0
Hutchinson	78	2	43.0	0.90	T.
Independence	78	15	48.2	4.95	T.
Jetmore	.....	.....	.....	0.80	T.
La Crosse	78	— 8	41.3	0.28	T.
Lakin	78	— 9	39.0	0.30	3.0
Lawrence	76	14	44.6	1.83	4.0
Lebanon	74	— 2	39.6	0.80	
Lebo	77	14	46.0	2.51	1.5
Macksville	74	— 5	39.9	0.50	0.2
McPherson	79	4	44.7	0.96	T.
Madison	79	10	45.6	2.23	1.0
Manhattan *b*	80	15	45.0	1.30	4.0
Manhattan *c*	80	15	44.6	1.31	3.0
Marion	76	20	45.0	1.35	T.
Medicine Lodge	80	2	45.8	0.92	
Minneapolis	75	5	42.7	0.55	2.5
Moran	77	13	46.8	2.39	1.0
Mounthope *1	77	12	45.0	0.83	
Ness City	80	— 2	42.5	0.10	
Norwich	76	7	45.2	1.05	
Olathe	75	15	45.6	2.69	6.0
Oswego	78	15	48.8	4.13	T.
Ottawa	77	13	45.0	2.48	3.5
Paola	78	14	46.6	2.50	5.0
Pittsburg	78	14	48.2	5.67	T.
Pleasanton	77	15	47.2	2.09	1.1
Pratt	77	— 3	43.4	0.38	T.
Republic	77	— 4	40.0	0.90	T.
Rome	78	12	46.4	1.65	T.
Salina	78	17	43.8	0.99	2.0
Sedan	78	14	47.6	2.13	T.
Seneca	77	12	42.8	0.91	6.0
Toronto	78	11	44.2	2.19	T.
Valley Falls	77	13	44.0	0.61	1.2
Viroqua	77	—15	39.2	0.30	3.0
Wakeeney	.....	.....	.....	0.90	0.5
Wallace	74	— 5	36.7	0.25	2.5
Walnut	76	16	47.6	5.36	0.6
Wamego *1	78	16	42.6	1.36	3.6
Winfield	79	12	46.0	1.61	T.
Yates Center	79	18	46.2	2.09	0.5
Kentucky.					
Alpha	82	26	55.2	6.83	
Anchorage	80	21	49.8	2.74	T.
Bardstown	80	21	52.3	3.46	
Beattyville	.....	.....	.....	5.06	
Berea	80	25	52.2	6.39	
Blandville	77	24	51.4	4.10	T.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Kentucky—Cont'd.	°	°	°	*Ins.*	*Ins.*
Bowling Green	77	23	53.8	3.10	
Burnside	81	25	53.2	5.65	
Cadiz [d]	79	32	55.2	4.07	
Carrollton	80	24	51.0	3.22	T.
Catlettsburg	83	22	53.4	4.64	T.
Earlington	79	23	51.6	3.34	T.
Edmonton	79	23	53.2	6.67	T.
Eubank	80	21	53.6	4.74	
Falmouth	.....	.....	.....	3.47	
Fords Ferry	81	21	50.2	2.55	T.
Frankfort	76	24	51.8	3.78	
Franklin	81	25	54.1	4.90	
Greensburg	81	23	51.8	6.01	
Henderson	80	24	50.8	4.63	0.2
Highbridge	80	26	52.4	4.60	T.
Hopkinsville	78	25	52.7	4.31	
Irvington	77	25	51.0	3.69	T.
Jackson	81	24	55.6	4.24	
Leitchfield	77	22	51.0	3.78	T.
Loretto	82	19	52.2	3.69	
Manchester	82	22	54.4	4.35	
Marrowbone	81	21	54.0	5.55	
Maysville	83	22	52.4	5.03	T.
Middlesboro	76	24	54.2	6.05	
Mount Sterling	77	22	51.9	5.84	
Owensboro	79	26	52.6	3.37	T.
Owenton	78	24	50.2	4.96	
Paducah *a*	.....	.....	.....	3.42	T.
Paducah *b*	82	25	54.2	3.42	T.
Pikeville	85	20	56.2	3.99	
Princeton	79	22	53.3	3.50	T.
Richmond	85	23	52.3	3.17	
St. John	78	20	51.4	3.64	
Scott	77	22	49.9	4.21	T.
Shelby City	81	20	52.2	5.52	
Shelbyville	81	23	51.8	3.63	T.
Taylorsville	77	22	51.4	3.97	
Williamsburg	.....	.....	.....	5.08	
Williamstown	77	22	50.9	3.25	
Louisiana.					
Abbeville	82	38	64.0	8.63	
Alexandria	82	35	62.1	9.10	
Amite	.....	.....	.....	16.34	
Baton Rouge	84	40	62.8	10.79	
Burnside	82	40	64.2	8.09	
Calhoun	80	35	61.0	6.95	
Cameron	76	42	63.0	5.93	
Cheneyville	82	38	61.8	11.59	
Clinton	81	37	61.9	21.47	
Collinston	84	34	60.0	5.65	
Covington	81	37	63.6	8.09	
Donaldsonville	89	41	65.2	6.55	
Emilie	79	43	62.2	5.00	
Farmerville	79	30	56.0	8.36	
Franklin	85	42	64.8	6.13	
Grand Coteau	80	40	63.6	9.77	
Hammond	79	39	63.5	10.15	
Houma	83	41	64.4	4.40	
Jennings	82	35	60.1	10.75	
Lafayette	81	42	62.5	8.65	
Lake Charles	82	41	62.8	9.42	
Lake Providence	82	31	59.4	5.20	
Lakeside	80	44	63.0	9.04	
Lawrence	82[c]	42[b]	62.8[c]	4.62	
Leesville	.....	.....	.....	9.17	
Libertyhill	82	31	60.3	7.35	
Mansfield	81	31	57.1	5.76	
Melville	88	42	62.8	15.68	
Minden	82	31	60.0	4.84	
Monroe	83	33	60.3	6.24	
New Iberia	.....	.....	.....	7.25	
Opelousas	81	39	62.6	13.94	
Oxford	82	32	57.8	.....	
Plain Dealing	81	29	57.9	4.22	
Port Eads	79	47	61.6	6.65	
Reserve	80	42	62.6	6.00	
Ruston	81	29	58.6	7.36	
St. Francisville	81	35	61.4	12.70	
Schriever	89	39	64.1	4.02	
Sugar Experiment Station	82	45	64.7	9.08	
Sugartown	77[c]	39	61.3	13.90	
Venice	86	49	61.3	4.34	
Wallace	83	40	63.6	5.33	
Maine.					
Bar Harbor	67	7	37.8	10.05	0.5
Belfast	64	4	39.2	8.94	1.0
Cornish	75	12	39.2	6.84	4.0
Danforth	.....	.....	.....	5.05	3.0
Fairfield	70	3	39.0	6.35	1.2
Farmington	79	1	37.6	5.67	1.5
Fort Fairfield	56	—17	29.8	.....	
Gardiner	78	7	39.2	6.65	1.0
Houlton	61	— 7	34.8	5.49	5.0
Jackman	.....	.....	.....	3.30	T.
Lewiston	82	9	39.4	6.32	1.8
Mattawamkeag	.....	.....	.....	6.56	3.0
Mayfield	62	— 2	35.7	5.33	3.0
Millinocket	61	1	37.8	6.39	3.0

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Maine—Cont'd.	°	°	°	*Ins.*	*Ins.*
Montague	.....	.....	.....	5.43	0.5
North Bridgton	80	8	39.4	5.62	3.0
Orono	64	0	37.5	6.22	2.0
Patten	64	— 9	36.4	3.02	T.
Rumford Falls	76	4	37.2	4.09	1.2
Solon	.....	.....	.....	4.90	.....
South Lagrange *1	62	— 2	37.2	.....	.....
The Forks	.....	.....	.....	4.42	4.5
Vanburen	58	—16	27.8	4.65	3.0
Winslow	74	3	34.6	7.15	1.5
Maryland.					
Annapolis	73	.....	.....	5.60	
Bachmans Valley	66	23	46.6	9.36	
Boettcherville	85	22	49.6	3.98	1.0
Boonsboro	73	23	49.6	3.75	
Cambridge	75	27	51.2	6.94	
Chase	72	20	48.8	4.98	
Cheltenham	75	21	50.4	5.59	
Chestertown	71	25	48.6	4.71	
Chewsville	72	23	48.7	3.23	T.
Clearspring	73	24	48.4	3.20	T.
Coleman	73	27	50.3	5.05	
Collegepark	71	21	48.6	5.54	
Colora	.....	.....	.....	4.55	
Cumberland	.....	.....	.....	2.77	
Darlington	72	22	49.8	4.18	
Deerpark	74	17	45.6	3.72	5.0
Denton	66	21	47.0	4.57	
Easton	73	23	51.2	5.49	
Fallston	70	23	48.5	4.28	
Frederick	74	24	51.5	4.22	
Grantsville	75	15	44.6	4.19	0.2
Greatfalls	77	20	49.4	6.23	
Greenspring Furnace	74	21	48.7	3.00	
Hancock	77	21	50.0	3.17	
Harney	.....	.....	.....	4.85	
Jewell	74	25	50.6	6.20	
Johns Hopkins Hospital	72	.....	.....	4.30	
Laurel	73	20	49.0	5.50	T.
McDonogh	70	22	47.7	5.55	
Mount St. Marys College	69	24	47.8	4.20	T.
New Market	72	23	50.0	5.94	
Pocomoke City	76	27	52.1	6.60	
Prince Frederickton	76	24	51.1	6.30	
Princess Anne	76	24	51.4	7.45	
Queenstown	73	28	49.5	4.86	
Sharpsburg	74	23	48.8	4.87	
Solomons	75	28	49.6	5.40	
Sudlersville	77	25	51.6	6.35	
Sunnyside	79	17	46.7	6.33	2.0
Takoma Park	74	23	48.7	5.53	
Van Bibber	65	22	46.2	5.06	
Westernport	79	25	48.9	3.07	2.0
Woodstock	73	25	51.5	4.99	
Massachusetts.					
Amherst	76	19	42.9	6.40	1.0
Bedford	76	23	42.9	5.98	T.
Bluehill (summit)	73	18	43.2	7.20	0.2
Cambridge	75	21	44.3	6.09	
Chestnuthill	76	18	44.8	6.62	T.
Cohasset	.....	.....	.....	7.34	
Concord	76	18	41.9	6.05	0.6
East Templeton *1	70	18	39.7	5.44	2.0
Fall River	65	22	44.4	7.13	
Fitchburg *a* *1	72	18	40.9	5.86	2.5
Fitchburg *b*	75	17	41.9	5.14	0.8
Framingham	75	16	43.9	6.34	.....
Groton	74	17	41.3	6.55	1.5
Holyoke	.....	.....	.....	6.55	.....
Hyannis	.....	.....	.....	7.25	
Jefferson	.....	.....	.....	6.85	0.5
Lawrence	76	18	42.6	5.39	0.5
Leominster	.....	.....	.....	5.86	2.2
Lowell *a*	73	20	43.5	5.90	
Lowell *b*	77	18	43.2	.....	
Ludlow Center	.....	.....	.....	5.98	
Middleboro	69	14	42.8	7.02	
Monson	71	18	42.8	6.73	
New Bedford *a*	63	19	42.5	8.02	
Pittsfield	.....	.....	.....	4.83	2.0
Plymouth *1	70	21	33.1	7.94	
Princeton	.....	.....	.....	6.52	.....
Provincetown	58	28	42.4	6.41	
Salem	.....	.....	.....	6.25	
Somerset *1	72	18	45.8	9.27	
Sterling	.....	.....	.....	6.37	1.2
Taunton	69	14	42.7	6.79	.....
Webster	.....	.....	.....	7.23	
Westboro	77	19	45.8	6.85	T.
Weston	74	17	42.4	6.30	0.2
Williamstown	71	21	41.6	4.67	0.8
Winchendon	.....	.....	.....	6.15	3.0
Worcester *b*	73	18	43.2	5.15	T.
Michigan.					
Adrian	80	.....	.....	0.50	T.
Agricultural College	75	16	41.0	1.25	T.
Allegan	75[d]	15[d]	40.0[d]	1.06	1.0
Alma	75	15	39.5	1.57	T.

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ann Arbor	77	12	41.7	1.79	T.
Annpere	70	18	37.8	0.37	
Arbela	73	12	39.4	1.65	
Baldwin	74	12	39.2	0.33	2.0
Ball Mountain	74	15	40.2	1.43	T.
Baraga	62	3	30.4	.....	
Battlecreek	76	15	41.0	0.65	T.
Bay City	74	13	39.6	1.26	T.
Benzonia	72[d]	18[d]	38.2[d]	3.39	3.0
Berlin	75	16	39.2	1.73	1.2
Berrien Springs	77	12	42.6	2.44	1.5
Big Rapids	74	10	36.8	1.78	4.0
Birmingham	70[e]	17[e]	39.0[e]	1.70	T.
Boon	69	9	34.6	2.12	5.5
Calumet	47	5	27.4	2.84	11.0
Carsonville	75	15	40.6	1.01	
Cassopolis	75	10	40.6	2.60	0.5
Charlevoix	70	13	36.8	3.15	1.0
Chatham	53	— 3	29.2	1.82	6.0
Cheboygan	72	3	34.7	3.30	T.
Clinton	79	18	42.6	1.30	T.
Coldwater	76	16	43.8	0.60	T.
Deerpark	40	5	30.8	2.83	7.0
Detour	48	— 2	31.4	5.07	5.0
Dundee	76	19	43.8	1.32	
Eagle Harbor	48	9	29.8	1.13	1.1
East Tawas	59	10	35.6	2.41	1.0
Eloise	77	17	43.4	1.02	
Ewen	58	— 1	28.2	2.08	1.0
Fennville	75[e]	16[e]	40.8[e]	1.99	1.5
Fitchburg	75	16	41.2	1.48	T.
Flint	76	14	40.1	1.67	T.
Frankfort	62	21	36.6	0.62	1.0
Gaylord	68	0	33.2	2.40	1.5
Gladwin	74	11	38.2	1.90	1.0
Grand Marais	51	10	31.4	2.07	3.0
Grand Rapids	75	14	40.2	2.48	
Grape	77	19	41.6	1.45	T.
Grayling	73	9	35.5	1.45	4.0
Hagar	76	19	41.1	3.35	3.5
Harbor Beach	74	12	39.0	1.06	
Harrison	.....	.....	.....	1.04	T.
Harrisville	60	13	35.3	1.86	4.7
Hart	74	20	37.6	0.31	
Hastings	76	14	40.9	1.12	0.3
Hayes	75	18	38.4	1.63	
Highland Station	.....	.....	.....	1.67	3.0
Hillsdale	76	15	41.1	1.48	T.
Humboldt	56	0	29.0	0.35	3.5
Iron Mountain	61	2	34.0	3.03	0.4
Iron River	62	— 1	31.8	2.70	2.0
Ironwood	56	— 4	30.3	1.72	2.0
Ishpeming	58	2	29.7	2.85	7.5
Ivan	71	7	35.6	1.36	6.0
Jackson	76	17	43.1	1.19	T.
Jeddo	75	9	39.7	1.20	0.4
Lake City	71	— 3	41.2	1.55	2.5
Lansing	81	16	41.4	1.52	0.5
Lapeer	78	8	40.6	.....	.....
Lincoln	72[d]	12[e]	39.6[e]	.....	.....
Ludington	60	15	39.6	.....	.....
Mackinac Island	58	0	32.8	4.54	0.7
Mackinaw	55	3	32.8	4.26	1.0
Mancelona	68	18	35.8	0.80	
Manistee	60[f]	25[f]	39.8[f]	3.00	1.0
Manistique	45	3	32.2	5.00	3.0
Menominee	56	5	34.4	3.23	T.
Midland	73	13	39.8	1.57	1.0
Mio	68	9	35.9	1.36	3.0
Montague	68	14	39.2	1.95	3.5
Mount Clemens	78[e]	26[e]	45.4[e]	0.85	T.
Mount Pleasant	75	12	38.3	1.50	
Muskegon	73	15	39.6	1.92	2.0
Newberry	50	10	32.8	.....	.....
Old Mission	74	12	37.4	3.99	1.0
Olivet	74	16	41.0	1.75	1.1
Omer	73	10	37.8	.....	.....
Onaway	73	10	37.0	2.32	T
Ontonagon	52	4	29.0	2.74	6.0
Ovid	76	15	40.3	1.16	T.
Owosso	78	11	42.4	0.20	
Petoskey	74	8	35.6	3.37	1.0
Port Austin	75	15	39.4	.....	.....
Powers	58	13	34.5	.....	.....
Reed City	.....	.....	.....	0.70	2.0
Roscommon	72	8	37.9	1.90	6.0
Saginaw	78	14	40.9	1.41	0.5
St. Ignace	55	10	34.3	.....	.....
St. Johns	75	16	41.4	.....	.....
St. Joseph	75	17	37.2	2.01	T.
Slocum	.....	11	.....	0.37	.....
South Haven	77	20	40.2	2.97	2.2
Thomaston	58	— 3	28.6	2.09	2.0
Thornville	76	15	40.4	1.46	
Traverse City	77	19	38.0	3.85	1.0
Vans Harbor	50	21	36.3	3.73	5.5
Vassar	74	5	43.0	1.15	
Wasepi	75	15	41.1	1.80	1.0
Waverly	70	16	38.8	1.30	0.4
Webberville	75	11	41.4	1.72	T.
West Branch	73	9	35.6	0.55	3.4
Wetmore	49	0	28.4	0.30	3.0
Whitecloud	74[e]	10[e]	36.1[e]	1.30	1.0
Whitefish Point	44	0	29.4	3.01	1.0
Ypsilanti	77	17	42.2	2.13	T.
Minnesota.					
Ada	54	1	26.4	0.65	7.0
Albert Lea	65	13	33.8	1.74	5.0
Alexandria	56	3	28.6	1.85	T.
Angus	46	— 2	20.5	1.40	
Ashby	59	6	28.3	1.25	0.8
Beardsley	55	3	28.6	0.55	
Beaulieu	48[e]	— 6[e]	21.5[e]	0.86	2.0
Bemidji	47	— 2	25.4	1.05	7.7
Bird Island	61	7	31.4	2.89	3.0
Blooming Prairie	64	8	34.0	2.30	5.
Caledonia	69	10	35.2	1.52	6.5
Collegeville	58	5	31.9	3.44	2.9
Crookston	.....	0	22.8[e]	0.80	8.0
Currie	65[e]	9[e]	31.6[e]	.....	.....
Deephaven	.....	.....	.....	1.83	4.0
Detroit	46	— 8	22.6	0.95	5.5
Duluth (sub station)	54	— 5	27.1	1.84	3.4
Faribault	64	7	33.8	1.10	3.6
Farmington	57	4	33.0	1.95	4.0
Fergus Falls	54	5	28.0	0.95	3.3
Floodwood	53	—12	27.0	1.12	T.
Glencoe	66	10	31.4	1.67	2.0
Grand Meadow	66	6	34.6	3.62	10.0
Hallock	47	— 9	20.9	0.88	9.0
Lake Winnibigoshish	49	— 8	23.4	0.79	3.5
Leech	53	— 7	23.8	1.19	2.7
Long Prairie	55	1	29.2	2.15	T.
Luverne	60	10	31.6	2.21	T.
Lynd	60	7	30.7	1.58	1.5
Mapleplain	59	3	32.2	1.98	5.0
Milaca	47[e]	— 3[e]	28.6[e]	2.47	
Milan	61	6	30.3	2.46	T.
Minneapolis[1]	57	5	33.1	1.60	3.5
Montevideo	61	— 2	28.2	2.92	0.7
Morris	58	8	28.8	1.10	0.1
Mount Iron	58	—16	25.3	0.48	3.5
New London	62	2	28.7	4.34	0.5
New Richland	65	8	35.0	1.45	2.0
New Ulm	64	9	34.4	3.48	4.0
Park Rapids	49	— 3	24.3	1.24	3.7
Pine River	53	0	26.0	1.83	3.0
Pipestone	56	7	30.8	1.57	
Pleasant Mounds	65	9	34.7	0.87	2.5
Pokegama Falls	60	—10	25.0	0.72	0.8
Redwing *a*	.....	.....	.....	0.73	5.5
Redwing *b*	63	3	35.4	1.41	.....
Reeds	.....	.....	.....	1.82	5.0
Rolling Green	60	9	33.5	1.35	2.0
St. Cloud	60	— 2	30.8	2.75	T.
St. Peter	64	9	35.2	1.69	1.3
Sandy Lake Dam	52	— 8	26.1	2.48	1.7
Shakopee	59	7	34.0	2.07	3.0
Thief River Falls	48	— 3	23.2	1.45	12.0
Tower	55	— 4	26.2	1.55	7.5
Two Harbors	56	6	27.8	2.84	2.2
Wabasha	65	6	37.4	1.93	5.0
Warroad	52	—10	20.2	1.02	10.2
Willow River	62	— 9	28.0	3.09	1.4
Winnebago City	65	12	34.1	1.03	1.7
Winona	67	7	37.1	2.55	6.0
Worthington	61	8	31.8	2.98	0.8
Wyoming	.....	.....	.....	1.70	4.5
Zumbrota[1]	60[e]	8	35.6	.....	
Mississippi.					
Aberdeen	78	32	57.8	6.82	
Agricultural College	78	32	59.0	4.63	
Austin	80	30	57.0	5.14	
Batesville	79	30	56.4	3.42	
Bay St. Louis	76[e]	46[e]	63.6[e]	12.72	
Biloxi	78	43	63.7	8.73	
Boggan	79[e]	31[e]	61.4[e]	7.76	
Booneville	80	31	56.9	6.20	
Brookhaven	.....	37	.....	13.07	
Canton	80	34	60.8	6.17	
Cleveland	82	36	61.2	3.66	
Columbus	78	34	58.2	6.02	
Crystalsprings	82	35	60.4	6.81	
Duck Hill	86	30	59.4	3.60	
Edwards	81	35	61.4	6.23	
Fayette	82	33	61.2	9.55	
Fayette (near)	.....	.....	.....	8.72	
Greenville *a*	77	33	58.6	5.76	
Greenville *b*	80	33	57.4	5.87	
Greenwood	81	32	59.1	4.53	
Hattiesburg	81	33	63.4	8.14	
Hazlehurst	82	36	60.6	6.90	
Hernando	79	30	58.6	2.98	
Holly Springs	76	29	55.2	3.48	
Indianola	80	32	58.0	3.40	
Jackson	81	36	60.3	8.06	
Mississippi—Cont'd.	°	°	°	*Ins.*	*Ins.*
Kosciusko	81	32	58.7	4.52	
Lake	77	32	58.2	6.24	
Lake Como	82	31	61.9	7.84	
Laurel	82	34	62.6	10.14	
Leakesville	81	33	62.9	4.09	
Louisville	79	31	58.5	3.86	
Macon	79	32	59.4	3.27	
Magnolia	81	35	61.8	11.74	
Natchez	85	37	63.4	8.75	
Nittayuma	82	32	60.0	4.98	
Okolona	81	32	58.1	6.47	
Patmos	.....	.....	.....	5.08	
Pearlington	81	38	63.6	8.84	
Pittsboro	78	30	58.0	5.72	
Pontotoe	77	31	57.6	4.24	
Poplarville	80	30	62.5	8.09	
Port Gibson	85[e]	33[b]	62.0[e]	6.91	
Ripley	76	27	56.1	4.28	
Shoccoe	80	33	62.0	6.11	
Stonington	.....	.....	.....	8.59	
Suffolk	81	35	61.3	9.41	
Swartwout	78	34	63.8	9.45	
Thornton	82	34	60.9	3.61	
Tupelo	80	31	58.6	4.88	
University	79	31	58.0	4.17	
Walnutgrove	84	30	61.7	5.41	
Watervalley	79	30	55.6	3.74	
Waynesboro	79	32	61.2	6.35	
Westpoint	80	35	60.4	6.21	
Woodville	79	36	61.6	14.98	
Yazoo City	82	35	59.4	3.58	
Missouri.					
Appleton City	77	15	46.6	4.45	
Arthur	78	16	47.3	4.67	
Avalon	77	11	45.7	2.68	0.2
Bagnell	.....	.....	.....	3.85	
Bethany	75	15	45.0	1.56	6.0
Birchtree	76	15	49.9	3.20	T.
Boonville	.....	.....	.....	3.56	0.6
Brunswick	79	16	44.8	2.13	T.
Carrollton	77	15	46.4	2.12	1.0
Caruthersville	79	26	53.3	6.14	T.
Conception	75	17	42.0	0.85	3.0
Cowgill	.....	.....	.....	2.25	1.8
Darksville	78	15	46.0	2.95	
Dean	80	11	49.6	3.57	
Desoto	73[d]	12	49.1	3.71	2.0
Downing	.....	.....	.....	1.27	0.4
Edgehill	76	20	48.5	2.68	0.2
Edwards	79	15	47.6	3.64	2.0
Eightmile[e][b]	.....	21	47.2	4.17	3.0
Eldon	79	14	47.7	3.90	T.
Fairport	.....	.....	.....	1.65	4.0
Fayette	78	19	47.4	3.58	T.
Fulton	79	15	46.8	3.18	T.
Galena	.....	.....	.....	4.38	T.
Gallatin[e][1]	80	24	46.1	2.37	6.0
Glasgow	78	16	45.9	2.91	0.5
Gorin	.....	.....	.....	2.37	1.0
Grant City	75	15	42.4	0.91	0.3
Halfway	77	15	48.3	5.05	1.0
Harrisonville	77	15	44.3	4.93	6.0
Hazlehurst	.....	.....	.....	1.63	2.0
Hermann	.....	.....	.....	3.58	T.
Houston	76	15	48.6	4.90	0.2
Huntsville	77	16	46.5	3.17	T.
Ironton	79	18	48.6	2.97	0.2
Jackson	79	20	50.8	6.24	3.0
Jefferson City	81	16	46.5	4.49	
Joplin	78	18[e]	50.6	3.15	0.2
Kidder	76	15	43.6	1.99	3.2
Koshkonong	76	17	50.8	4.76	1.0
Lamar	78	15	49.2	8.63	T.
Lamonte	.....	.....	.....	3.48	1.5
Lebanon	76	14	48.0	4.81	
Lexington	77	16	46.3	2.51	3.0
Liberty	75	15	45.1	1.89	3.0
Louisiana	78	16	46.4	3.91	
Macon	78	14	46.4	2.10	T.
Marblehill	80	21	50.4	4.93	
Marshall	78	17	46.4	3.58	0.5
Maryville	75	13	40.2	1.47	4.0
Mexico	80	10	46.2	2.59	T.
Miami[e][b]	77	17	45.6	2.40	0.5
Mineralspring	78	13	49.6	3.75	0.5
Monroe City	78	13	44.8	2.55	T.
Montreal	75[d]	12[d]	45.2[d]	3.41	1.0
Mountaingrove	74	15	48.2	4.79	T.
Mount Vernon	80	15	49.6	4.56	T.
Neosho	78	14	49.4	3.45	0.5
Nevada	.....	.....	.....	3.23	T.
New Haven	81	18	48.4	3.37	
New Madrid *b*	.....	.....	.....	4.37	
New Palestine	78	17	48.3	3.68	T.
Oakfield	80	17	48.4	3.73	1.3
Olden	74	16	49.5	3.87	T.
Oregon	76	15	42.8	1.34	3.0
Palmyra[e][b]	78	16	43.7	1.72	0.2

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Pine Hill				4.04	T.
Poplarbluff	79[4]	21[4]	51.2[4]	6.36	T.
Princeton	75	15	42.3	2.33	4.0
Protem	77	22	51.5	4.26	0.8
Richmond				1.58	3.0
Rockport				1.29	5.0
Rolla				4.92	1.4
St. Charles	79	17	47.6	3.13	0.8
St. Joseph				1.20	2.0
Sarcoxie				4.52	T.
Sedalia	78	15	46.8	4.25	T.
Seymour	74	13	47.7	4.42	1.5
Shelbina				2.48	
Sikeston	76	23	50.8	5.18	T.
Steffenville	78	15	47.2	2.50	T.
Sublett	77	12	41.6	3.80	T.
Trenton	74	16	43.8	2.04	3.0
Unionville	74	14	41.8	1.86	1.0
Vichy	79	12	47.2	4.98	2.0
Warrensburg	79	16	47.8	4.55	2.0
Warrenton	80	9	45.4	3.92	0.5
Wheatland				4.09	1.6
Willowsprings	76	15	48.9	3.55	T.
Windsor	78[f]	16[f]	46.3[f]	4.71	0.4
Zeitonia	79	19	49.4	4.04	0.6
Montana.					
Adel	59	−15	23.8	2.01	17.5
Augusta	62	−13	25.7	1.00	10.0
Billings	69	8	31.8	0.55	5.5
Boulder	57	− 7	26.8	0.98	7.5
Bozeman	60	0	27.6	0.67	
Butte	56	6	30.8	1.30	11.0
Canyon Ferry	61	− 5	29.1	0.78	7.4
Chinook	65	− 8	19.6	0.48	6.0
Columbia Falls	60	2	32.4	0.27	T.
Culbertson	59	−18	20.7	0.05	
Dayton	62	9	34.6	0.55	1.0
Deerlodge	60	− 4	29.4	0.10	1.0
Dillon	60	− 4	29.2	1.23	11.3
Ekalaka	62	− 5	27.2		
Fort Benton	54	− 8	20.0	0.80	8.0
Fort Logan	65	−11	26.0	0.51	
Glasgow	66	− 5	22.4	0.18	
Glendive	66	−10	23.2	0.40	4.0
Greatfalls	63	− 7	27.2	0.89	8.0
Hamilton	66	6	36.0	0.45	9.5
Kipp	56	−15	19.0	1.17	11.7
Lamedeer	68	− 4	30.4	0.70	7.0
Lewistown	66	− 6	27.6	0.55	5.5
Livingston	64	−15	25.0	0.01	0.2
Manhattan	64	− 7	30.4	0.45	4.5
McMillan	66	0	26.9	0.20	2.0
Marysville	53	− 8	24.9		
Missoula	65	10	36.6[l]	1.28	5.0
Ovando	53	−10	25.8	1.11	7.8
Parrot	63	0	30.9	0.62	6.2
Plains	64	13	34.8	0.50	4.0
Poplar	63	−15[h]	21.9[e]		
Redlodge	60	− 7	25.9	0.43	12.2
Ridgelawn	64	−17	22.4	0.22	2.2
St. Pauls	62	− 5	24.0	0.18	5.8
St. Peter	58	−11	25.8	1.00	21.5
Springbrook	66	−10	21.8	0.75	5.5
Summit	51	−14	21.2	6.85	58.0
Toston	66	− 7	25.1	0.56	5.8
Troy	70	7	35.7	3.49	4.0
Twin Bridges	61[h]	− 5[h]	29.4[h]		
Twodot	65	0	26.8	1.50	13.0
Utica	61	− 9	26.6	1.11	9.5
Wibaux[1]	76	−10	28.8		
Winston[k]	47	− 3	21.6		
Wolf Creek	62	− 6	28.3	1.76	10.2
Yale	63	−10	25.7	2.23	22.0
Nebraska.					
Agate	79	−11	30.6	0.37	4.0
Agee[*1]	70	0	30.6	0.50	
Albion	68	3	36.0	1.61	4.0
Alliance	76	− 1	35.0	T.	T.
Alma	78	− 9	39.2	0.79	3.3
Ansley	72	10	33.6	0.41	0.3
Arapahoe				0.70	4.0
Arcadia	70	8	35.8		
Ashland *a*	75	11	40.6	0.50	4.0
Ashland *b*				0.62	1.2
Ashton				1.32	3.0
Auburn	75	12	42.0	0.97	4.0
Aurora				1.11	1.0
Bartley	71	7	34.8	0.68	5.0
Beatrice	75	9	40.4	0.97	3.0
Beaver	77	− 2	38.2	0.93	3.0
Bellevue				0.72	1.0
Benedict				1.91	0.2
Benkleman[*1]	70	0	35.6	0.08	1.0
Blair	75	9	36.2	0.74	0.1
Bluehill[*1]	55	− 8	33.4	0.20	1.0
Bradshaw				1.27	3.0
Bridgeport	73	4	35.8	0.47	4.5
Brokenbow	74	0	34.9	0.35	T.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Burchard				0.80	5.0
Burwell				0.15	
Callaway	71	2	32.4	0.10	1.0
Cedar Rapids	64	5	32.2	1.43	2.9
Central City				1.72	3.2
Chester				0.10	1.0
Cody				0.37	3.7
Columbus	66	7	36.0	1.58	2.5
Crete	74	10	39.8	0.55	1.3
Culbertson				0.58	3.7
Curtis	73	− 3	35.6	0.60	6.0
David City	71	10	37.4	0.65	1.8
Dawson	76	13	42.5	1.12	3.0
Edgar				0.48	0.7
Ericson				0.25	0.5
Ewing				0.74	
Fairbury	76	12	39.8	0.74	3.0
Fairmont	74	2	36.6	0.34	1.5
Fort Robinson	89	− 6	33.1	1.75	8.5
Franklin[c]	77	6	36.2		
Fremont	75	15	37.0	0.73	2.0
Geneva	75	12	38.4	0.38	0.4
Genoa (near)	66	0	35.7	2.17	5.0
Gering	70	1	35.4	0.48	2.5
Gordon				0.25	2.5
Gosper				0.44	1.7
Gothenburg	73	1	35.3	0.44	4.3
Grand Island	69	− 4	36.0	1.39	2.6
Greeley				0.55	
Guide Rock				1.12	1.0
Halsey				0.24	
Harvard	72	− 5	36.4	1.31	4.8
Hastings[*1]	66	4	35.7	0.45	4.2
Hayes Center				T.	
Hay Springs	72	− 4	29.0	0.92	9.3
Hebron	75	1	39.4	0.58	1.0
Hickman				0.65	2.5
Holbrook				0.81	5.0
Hooper[*1]	65	14	36.3	1.08	1.7
Imperial	76	− 6	35.6	0.30	0.9
Johnstown				0.10	
Kearney	70	− 2	37.0	1.21	2.5
Kennedy	76	− 1	34.6	0.30	3.0
Kimball	67	5	33.4	0.50	5.0
Kirkwood	75	4	34.4	0.67	0.2
Leavitt	74	14	38.3	0.90	T.
Lexington	65	3	34.6	0.83	5.0
Lockridge	73[e]	0[e]	38.6[e]	1.36	3.0
Lodgepole	70	0	34.0	0.52	0.2
Loup	70	2	34.6	1.67	4.0
Lynch	75	5	34.4	0.70	0.8
Lyons				1.25	1.2
McCook[*1]	65	7	38.8	0.25	2.5
McCool Junction				0.87	2.0
Madison	66	5	34.9	2.00	2.0
Madrid	78	− 8	35.5	0.10	T.
Marquette				1.18	3.0
Mason				0.45	
Minden *b*	70	− 2	36.0	1.17	2.4
Monroe				1.33	3.0
Nebraska City *c*	74	13	40.9	0.79	2.5
Nemaha				0.61	2.0
Norfolk	69	2	34.6	1.65	2.0
North Loup	69	1	35.9	1.10	2.0
Oakdale	66	4	33.7	1.50	0.8
Odell				0.92	5.0
O'Neill	73	6	35.0	0.59	T.
Ord				0.26	
Osceola				1.45	
Palmer				0.66	4.0
Palmyra[*1]	76	12	38.8	0.67	
Pawnee City				1.30	4.0
Plattsmouth *a*				0.84	3.0
Plattsmouth *b*	71	18	40.0	0.64	2.0
Purdum	75	− 3	33.4	0.09	
Ravenna *a*	68	− 3	35.5	1.50	3.5
Redcloud	73	− 2	39.0	0.33	1.5
Rulo				0.69	2.5
St. Paul	68	− 4	37.0	1.70	5.5
Salem[*1]	72	16	42.8	0.75	2.5
Santee	74	9	35.8	1.10	0.8
Seneca[*1]	70	12	33.6		
Seward	74	8	37.8	1.17	3.0
Smithfield				0.50	3.0
Spragg				0.04	0.1
Springview	75	2	32.8	0.44	
Stanton	68	5	35.8	1.87	T.
Strang[*1]	72	6	40.1	0.93	3.0
Stratton				0.45	2.0
Superior	75	− 4	35.6	0.20	
Syracuse				1.00	2.0
Tablerock				1.33	5.0
Tecumseh *b*	70	10	40.7	1.80	1.8
Tecumseh *c*				1.12	3.5
Tekamah	75	13	39.8	1.08	3.2
Turlington	74	11	40.6	0.76	4.2
University Farm	75	11	40.0	0.57	2.1
Wakefield	68	9	36.4	2.04	0.5

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Wallace				T.	T.
Weeping Water				0.75	2.2
Westpoint	68	13	38.2	1.01	
Wilber[*1]	74	16	39.5	0.75	0.5
Wilsonville				0.32	2.7
Winnebago	66	6	36.8	0.99	
Wisner				2.12	3.5
Wymore				0.70	
York	73	2	39.4	0.65	1.0
Nevada.					
Austin	58	10	34.0	2.40	
Battle Mountain	70	15	41.0	0.92	3.0
Belmont	55	7	31.6	1.15	9.0
Candelaria	66	19	40.6	0.23	1.5
Carson City	66	16	40.8	2.07	7.4
Dyer	67	6	40.2	0.50	
Elko	68	5	36.4	2.80	22.0
Ely	59	− 5	33.3	0.10	1.0
Eureka	62	6	33.6	3.50	42.5
Fenelon[*1]	65	0	32.2	1.00	7.0
Golconda[*1]	65	16	44.5	0.30	3.0
Hamilton	52	4	30.4	2.73	27.3
Hawthorne	70	17	43.6	T.	
Humboldt	65	18	40.6	0.10	3.5
Lee				2.14	26.0
Lewers Ranch	65	12	40.1	4.67	13.5
Lovelocks	70	16	46.6		
Martins	70	10	42.8	1.47	5.5
Mill City	70	23	42.0		
Monitor Mill	59	− 2	31.9	0.80	8.8
Morey	62	1	34.8	3.00	24.0
Palisade	66	3	36.0	0.91	7.0
Palmetto	67	5	37.4	2.88	17.5
Potts	60	− 8	32.2	0.72	15.2
Reno State University	64	18	40.5	0.53	
Rioville	90	25	59.2	0.38	0.0
Silverpeak	72	17	43.5		1.0
Sodaville	71	18	43.7	0.10	1.0
Tecoma	68	− 3	32.1	0.54	5.1
Toano[*5]	59	0	32.4	0.50	4.0
Wabuska	70	12	41.0	1.01	1.5
Wadsworth	69	14	42.8	1.22	8.2
Wood	63	5	33.6	1.70	24.0
New Hampshire.					
Alstead	70	16	39.8	6.13	4.0
Berlin Mills	77	− 3	36.8	3.59	
Bethlehem	70	7	37.4	5.41	9.0
Brookline[*1]	76	14	41.1	5.88	2.5
Chatham	70	2	36.4	2.95	3.0
Concord	76	12	40.1	5.15	3.0
Durham	78	17	41.4	6.63	1.0
Franklin Falls	74	14	38.8	5.60	3.0
Grafton	75	6	37.6	4.55	2.0
Hanover	75	12	40.4	4.90	1.8
Keene	79	14	41.0	4.67	2.0
Littleton	68	6	33.7	4.95	9.0
Manchester				5.82	3.3
Nashua	78	18	41.4	5.29	1.0
Newton	78	15	41.2	5.99	0.5
North Stratford				2.89	7.1
Peterboro	75	12	40.4	6.48	2.5
Plymouth	73	8	38.0	5.29	0.8
Sanbornton	74	8	37.5	5.49	4.0
Stratford	73	− 2	37.0	3.98	4.5
West Stewartstown				3.71	4.0
New Jersey.					
Asbury Park	69	25	45.1	4.38	
Barnegat	74	18	47.4	8.05	
Bayonne	73	25	47.4	4.44	
Belvidere	73	22	47.7	5.07	
Bergen Point	73	24	47.3	4.77	
Beverly	75	23	48.9	4.54	
Blairstown	71	21	46.2	5.03	
Bridgeton	76	25	50.4	6.79	
Camden	74	30	50.0	4.97	
Canton				4.80	
Cape May C. H	71	23	47.8	6.34	
Charlotteburg	72	14	45.5	5.93	
Chester	72	20	45.4	6.05	T.
Clayton	75	23	49.0	4.50	
College Farm	74	24	48.0	4.74	
Dover	72	18	45.0	5.49	
Elizabeth	73	23	48.3	5.57	
Englewood	71	25	47.5	4.05	
Flemington	74	21	49.1	4.42	
Freehold	75	24	47.3	4.93	
Friesburg	73	22	48.9	5.77	
Hanover[7]	72	19	47.0	4.24	T.
Hightstown	75	25	48.7	4.59	
Imlaystown	76	25	49.4	4.30	
Indian Mills	79	20	50.0	4.69	
Lakewood	75	22	48.2	4.69	
Lambertville	74	25	49.0	4.42	
Layton	72	14	45.0	4.27	
Moorestown	76	24	48.8	5.28	
Mount Pleasant				5.42	
Newark	43	25	47.3	4.08	
New Brunswick	75	25	49.4	4.82	T.

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
New Jersey—Cont'd.	°	°	°	*Ins.*	*Ins.*
Newton	74	20	45.8	4.92	
Oceanic	68	25	47.6	5.19	
Paterson	73	23	48.6	5.40	
Pemberton	77	23	48.6	3.60	
Perth Amboy [b]	71	35	51.6	2.75	
Phillipsburg	71	25	47.4	4.39	
Plainfield	73	21	47.0	4.08	T.
Rancocas				4.84	
Ringwood	72	13	45.8	5.47	
Rivervale	73	16	46.2	5.14	
Salem	72	24	48.6	5.33	
Somerville	73	22	48.0	4.42	
South Orange	70	22	46.9	4.51	T.
Sussex	73	19	45.9	3.79	
Toms River	74	29	48.0	5.34	
Trenton	75	30	51.8	5.55	
Tuckerton	70	19	47.2	8.07	
Vineland	75	22	49.5	6.39	
Woodbine	71	29	47.6	8.53	
Woodstown				4.63	
New Mexico.					
Alamagordo	83	29	32.2	0.40	T.
Albert	83	2	45.0	T.	
Albuquerque	89	12	47.2	0.38	
Alma	78	12	44.2	0.29	
Arabella	77	14	47.3	T.	
Bellranch				0.36	
Cambray				0.80	
Carlsbad	90	19	53.8	T.	
Cloudcroft	51	— 2	32.6	0.90	9.0
Deming				1.00	
Dorsey	71	— 1	40.0	0.22	3.0
Eagle Rock Ranch	72	—12	38.2	0.18	1.4
Engle	78	22	47.0	0.83	
Fort Bayard	76	16	46.2	1.27	
Fort Stanton	73	9	41.4	0.17	0.1
Fort Union	75	10	40.4	0.11	T.
Fort Wingate	64	2	33.9	0.45	2.0
Fruitland	71	11	41.8	0.10	T.
Gage				0.90	
Gallisteo	65	5	43.7	0.45	
Gallinas Spring	75	— 6	42.2	0.27	
Golden				1.04	T.
Hot Springs	72	— 8	40.2	0.08	T.
Las Vegas	72	—11	39.8	0.13	T.
Lordsburg				0.90	
Los Lunas	79	20	46.1	0.55	
Luna	72	9	38.3	0.58	
Mesilla Park	83	17	49.6	0.37	
Mountainair	71	0	40.4	0.46	3.0
Raton	87	0	40.4	0.05	
Roswell	88	14	49.6	0.10	
San Marcial	81	12	49.8	T.	
Strauss				0.40	
Taos	67	— 5	38.6	1.40	.....
Winsors	61	—17	32.1	1.02	.....
New York.					
Adams				2.52	6.0
Addison	78	20	43.8	4.56	T.
Adirondack Lodge	64	0	34.4	5.72	20.1
Akron				3.44	.....
Alden	76	18	43.0	4.80	0.5
Amsterdam				5.41	3.4
Angelica	80	17	43.4	4.60	T.
Appleton	79	19	40.6	2.55	T.
Arcade	74	12	39.6	4.22	2.0
Athens	74	20	44.4	4.21	T.
Atlanta	76	18	41.4	5.02	T.
Auburn	79	20	42.7	4.75	T.
Avon	81	10	41.8	3.18	T.
Axton	70	— 1	35.3	4.56	12.5
Baldwinsville	75	18	42.6	5.65	1.0
Bedford	78	26	49.2	3.53	
Blue Mountain Lake				5.75	5.5
Bolivar	76	16	42.4	4.75	0.4
Bouckville	71	10	39.7	4.70	4.5
Boyds Corner				6.30	.....
Brockport	79	18	41.8	3.48	1.0
Caldwell	66	16	39.8	6.37	5.0
Canaan Four Corners	73	12	41.8	3.51	
Canajoharie	75	18	40.0	5.66	1.8
Carmel	72	18	44.8	5.90	
Carvers Falls	70	12	40.1	5.74	2.0
Cedarhill	75	20	43.2	3.76	T.
Chazy	69	1	37.0	3.73	0.5
Cooperstown	70	17	39.5	5.84	1.0
Cortland	75	19	44.2	5.13	
Cutchogue	65	23	44.6	7.51	
Dekalb Junction				2.85	4.5
De Ruyter	72	15	40.2	4.90	1.2
Easton				4.75	4.5
Elba	76	17	39.7	3.57	3.5
Elmira	80	22	44.9	4.25	
Fayetteville	78	18	42.8	4.69	T.
Franklinville	74	15	42.2	4.04	0.2
Gabriels	76	9	36.5	2.99	
Gansevoort				7.09	3.0
Glens Falls	73	16	42.2	6.49	3.5
Gloversville	73	15	39.2	7.32	3.0
Greenwich	73	19	41.8	5.86	1.0
Griffin Corners	70	14	40.8	4.23	T.
Harkness	73	1	38.4	3.33	0.8
Haskinville				5.46	T.
Hemlock	71	20	42.0	3.89	.....
Indian Lake	67	4	35.8	4.83	4.5
Ithaca	75	21	42.1	4.62	T.
Jamestown	77	18	44.8	3.73	0.5
Keene Valley	77	0	39.3	3.79	2.5
King Ferry				5.21	T.
Liberty	70	13	40.8	5.11	.....
Littlefalls, City Res.	74	16	39.7	5.21	0.5
Lockport	76	19	41.4	2.82	T.
Lowville	71	14	37.8	3.33	1.0
Lyndonville				2.43	.....
Lyons	80	19	43.5	4.49	1.5
Middletown	67	21	45.2	3.35	T.
Mohonk Lake	65	21	43.0	4.60	T.
Moira	72	2	37.1	3.30	4.0
Mount Etrick	70	16	39.7		
Newark Valley				4.66	1.0
New Lisbon	71	12	39.0	5.77	T.
North Hammond	72	14	41.4	2.48	0.5
North Lake				4.79	5.0
Nunda	78	18	43.4	4.17	T.
Ogdensburg	68	5	37.8	2.29	1.0
Old Chatham				4.80	
Oneonta	74	18	42.0	5.90	T.
Oswegatchie	79	7	38.9	4.56	4.9
Otto	73	13	41.8	3.33	
Oxford	72	15	41.0	5.64	1.3
Palermo				3.91	3.9
Penn Yan	75	21	41.4	4.43	T.
Perry City	74	14	40.8	5.34	0.7
Plattsburg	63	13	35.4	4.15	T.
Port Jervis	73	17	44.8	3.68	
Primrose	73	18	44.6	5.43	
Redhook				5.03	
Richmondville	73	17	42.0	5.16	T.
Ridgeway	76	19	41.4	3.31	1.2
Rome	75	19	42.0	5.95	2.0
Romulus	76	19	42.5	5.44	T.
Salisbury Mills				4.09	
Saranac Lake	76	5	38.0	4.85	4.7
Setauket	68	22	45.3	7.35	
Shortsville	78	19	42.1	3.83	0.5
Skaneateles				5.70	.....
Southampton	63	23	43.6	6.82	
South Butler	78	17	41.6	5.16	0.8
South Canisteo	76	17	41.0	4.64	1.0
Southeast Reservoir				5.19	
South Kortright	72	15	41.8	4.74	T.
South Schroon	72	12	37.6	5.80	6.1
Speer Falls	71	18	41.6	6.18	
Straits Corners	74°	17°	40.8°	4.56	T.
Ticonderoga	70	18	40.6	3.87	1.8
Volusia	75	17	41.2	2.51	1.0
Walton	73	16	41.8	5.19	0.7
Wappinger Falls	73	20	45.6	4.72	T.
Warwick				3.34	
Watertown	74	11	40.2	3.82	3.5
Waverly	78	17	43.8	4.27	T.
Wedgwood	74	17	40.2	5.42	0.5
West Berne	78	16	40.8	5.15	
Westfield *b*	75	16	41.8	3.11	
Westfield *c*				3.44	T.
Windham	70	17	42.5	4.47	T.
Youngstown				2.27	
North Carolina.					
Brevard	76	19	53.9	17.10	T.
Brewers	75	21	53.1	9.91	T.
Bryson City				8.69	
Chapelhill	79	27	56.7	10.89	
Currituck				2.12	
Edenton	77	33	58.6	5.15	
Fayetteville	83	32	60.7	8.79	
Goldsboro	78	32	58.0	5.89	
Graham				8.45	
Greensboro	74	27	55.0	8.12	
Henderson	75	39	57.0	10.74	
Hendersonville	73	25	52.4	10.56	T.
Henrietta	78	28	56.6	9.18	
Highlands	66	18	47.4	17.52	
Horse Cove	67	25	50.6	14.16	
Hot Springs	76	27	56.0	.....	
Jefferson	68	22	49.8	8.32	4.0
Kinston	81	34	60.0	8.05	
Lenoir	76	23	53.4	11.15	
Lexington	79	21	57.1	7.58	T.
Linville	64	17	45.1	9.55	4.0
Littleton	77	26	53.4	9.58	
Louisburg	78	30	56.9	7.42	
Lumberton	79	36	60.4	5.87	
Marion	75	25	53.2	9.26	0.5
Marshall	73°	23°	53.4°	7.10	
Mocksville	75	32[b]	54.6°	7.30	
Moncure	81	23	58.1	6.89	
Monroe	79	28	58.5	6.53	
Morganton	74	23	54.2	9.29	
Mountairy	73	23	53.0	7.53	
Murphy				6.99	
Newbern	80	36	60.5	5.20	
Patterson [a]	72	24	48.8	8.07	
Pittsboro	81	25	57.5	7.89	
Reidsville	77	26	54.8	6.56	
Rockingham	83	33	60.6	3.44	
Roxboro	76	24	54.6	8.18	
Salisbury	76	28	57.7	8.66	
Salem	76	24	54.2	6.63	
Saxon	76	29	52.6	6.75	
Selma	79	35	58.7	4.38	
Settle	75	28	55.2	9.47	
Sloan	79	35	59.8	6.21	
Soapstone Mount	77	23	54.2	7.92	
Southern Pines *a*	82	29	60.4	5.05	
Southern Pines *b*	79	31	59.8	4.95	
Southport	79	38	60.2	6.33	
Springhope	80	32	58.8	5.13	
Statesville	76	23	54.6	8.66	
Tarboro	78°	34°	59.6°	5.48	
Washington	80	37	60.9	5.24	
Waynesville	72	28	54.3	7.85	T.
Weldon *a*	77	32	54.9	6.26	
Weldon *b*				6.09	
North Dakota.					
Amenia	52	2	25.6	0.50	5.0
Ashley	59	— 6	22.4	0.60	6.0
Berlin	57	— 6	23.2	1.56	15.6
Bottineau	46	—14	16.4	0.20	2.0
Buxton	49	— 6	24.6	1.17	11.7
Churchs Ferry	50	— 9	18.0	0.74	4.9
Coalharbor	80	— 7	21.8	0.35	3.5
Devils Lake	49	— 8	19.8	0.53	4.5
Dickinson [b]	68	— 6	28.8	T.	T.
Donnybrook				0.50	5.0
Dunseith	57	—15	17.9	0.50	5.0
Edgeley	56	— 3	25.6	0.88	8.8
Elbowoods	63	— 8	20.5	.....	
Ellendale	58	— 3	27.1	0.70	7.0
Fargo	50	— 5	22.1	0.42	4.0
Forman	55	0	26.1	0.32	3.4
Fort Yates	73	— 5	27.0	0.41	4.1
Fullerton	55	— 6	23.9	1.17	11.7
Gallatin	53	—19	22.2	0.90	9.0
Glenullin	67	— 4	26.2	0.30	2.7
Grafton	51	— 1	21.6	0.80	7.0
Hamilton	50	— 5	19.6	1.58	6.2
Hannaford	55	—15	22.0	0.46	4.6
Jamestown	48	— 8	21.4	0.83	8.3
Larimore	55	— 6	20.4	0.70	6.0
McKinney	61	—24	15.5	.....	.....
Mayville	49	1	22.8	0.93	9.3
Medora	67	— 5	28.0	0.35	3.0
Melville	53	— 2	23.0	0.22	2.2
Milton	42	— 9	18.2	0.40	3.5
Minnewaukon	50	— 5	21.6	0.00	
Minot	67	— 5	22.0	0.60	6.0
Minto	53	— 3	20.6	1.19	10.3
Napoleon	62	— 7	23.6	0.55	4.5
New England	65	—10	25.8	0.20	2.0
Oakdale	63	— 2	24.3	0.45	4.0
Pembina	44	— 6	18.1	0.66	5.6
Portal	46	—17	12.0	0.70	7.0
Power	52	0	25.2	0.40	4.0
Steele	61	— 3	21.9	0.40	4.0
University	49	0	22.2	0.51	5.0
Wahpeton	56	6	29.2	0.48	3.0
Willow City	60°	—14°	18.0°	0.20	2.0
Woodbridge	46	—12	17.1	0.55	5.5
Ohio.					
Akron	75	22	45.4	2.69	0.8
Atwater				4.20	T.
Bangorville	76	18	45.3	4.50	0.5
Bellefontaine	76	18	45.9	2.38	T.
Bement				2.00	0.5
Benton Ridge	77	22	44.8	1.94	0.5
Bladensburg	78	17	45.8	3.70	
Blaine				6.43	2.0
Bloomingburg				5.06	T.
Bowling Green	78	21	43.6	1.97	T.
Bucyrus	76	20	45.8	2.50	T.
Cambridge	79	20	49.2	5.33	
Camp Dennison	80	19	49.5	5.63	
Canal Dover	76	21	46.6	4.44	
Canton	75	21	46.1	4.30	T.
Cardington	75	20	45.6	2.97	0.5
Cedarville				4.10	
Centerburg				5.11	0.5
Circleville	80	22	48.6	3.35	
Clarington	81	19	50.0	5.00	
Clarksville	77	22	49.0	4.79	T.
Cleveland *a*	76	22	44.8	2.43	0.5
Cleveland *b*	76	21	44.0	1.69	T.
Clifton	77	12	48.0	3.14	
Coalton	84	18	51.0	6.10	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Colebrook	75	20	45.2	2.96	0.2
Coolville				4.12	T.
Coshocton				3.61	
Dayton *a*				3.15	T.
Dayton *b*	77	22	47.6	3.69	T.
Defiance	78	20	44.2	2.11	T.
Delaware	77	21	46.6	3.54	0.2
Demos	76	23	48.2	5.84	T.
Dunham				5.09	
Dunkirk				1.65	
Elyria	79	21	45.6	2.46	
Findlay	80	21	45.0	1.62	
Frankfort	79	21	49.0	4.42	
Fremont	79	24	45.2	2.05	
Garrettsville	76	19	45.5	3.67	1.2
Granville	78	21	48.2	4.15	T.
Gratiot	77	26	47.8	3.67	0.3
Green	79	20	52.1	3.45	
Greenfield	76	23	49.4	4.41	T.
Greenhill	76	17	45.7	4.48	0.1
Greenville	77	20	46.6	3.01	T.
Hanging Rock	81	19	52.7	4.14	
Hedges	76	21	44.0	2.30	
Hillhouse	78	16	42.2	1.75	T.
Hiram	74	17	44.5	3.58	2.0
Hudson	77	11	45.2	2.65	2.0
Jacksonboro	79	19	45.8	3.82	
Kenton	76	20	46.0	3.16	T.
Killbuck	77	19	46.6	3.89	T.
Lancaster	78	21	49.0	4.39	T.
Lima	76	21	45.0	1.90	T.
McConnelsville	80	21	49.4	4.85	T.
McCormick				4.89	T.
Manara	76	20	47.4	5.00	T.
Mansfield				2.69	
Marietta	79	25	50.4	5.15	
Marion	79	20	46.5	2.60	T.
Medina	77	20	45.7	2.26	T.
Milfordton	76	18	43.7	4.46	0.5
Milligan	76	20	48.8	3.47	
Millport	75	17	46.2	4.44	T.
Montpelier	75	18	42.6	1.66	T.
Napoleon	77	21	45.0	1.74	
New Alexandria	78	22	47.9	4.70	T.
New Berlin	75	20	46.0	3.51	T.
New Bremen	78	21	47.3	2.42	T.
New Lexington				4.19	T.
New Richmond	78	23	50.7	3.88	
New Waterford	76	18	46.0	5.34	
North Lewisburg	78	18	45.8	3.00	
North Royalton	76	19	44.9	2.00	1.0
Norwalk	78	23	44.8	2.62	0.5
Oberlin	78	22	45.3	2.33	T.
Ohio State University	75	22	47.0	4.28	T.
Orangeville	77	18	46.6	4.67	1.0
Ottawa	79	21	45.2	2.00	
Pataskala	77	20	47.3	5.05	0.3
Philo	78	20	49.0	4.17	T.
Plattsburg	78	19	46.6	3.69	T.
Pomeroy	81	23	52.2	4.09	
Portsmouth *a*				4.63	T.
Portsmouth *b*	85[1]	23	54.2[e]	4.62	T.
Pulse	78	20	50.2	3.57	
Redlion				2.61	
Richfield				2.61	1.0
Ripley	76	21	49.2	4.29	T.
Rittman	89	20	48.4	3.35	T.
Rockyridge	78	21	43.6	2.07	T.
Shenandoah	75	19	43.6	2.56	T.
Sidney	78	22	47.4	2.63	0.7
Somerset	79	20	50.2	1.50	T.
Springfield				3.01	T.
Strongsville				3.18	
Swanton				4.89	T.
Thurman	80	23	52.2	4.81	
Tiffin	75	23	44.4	2.58	0.2
Upper Sandusky	76	22	46.4	3.02	T.
Urbana	73	20	44.0	2.58	T.
Vickery	78	22	43.8	1.79	
Wadsworth				2.58	
Walnut				3.51	T.
Warren	79[f]	27	47.2[e]	4.03	1.6
Warsaw	77	17	46.8	4.41	0.2
Wauseon	80	20	43.4	2.51	1.0
Waverly	81	20	50.4	4.59	T.
Waynesville	77	21	47.6	5.19	
Wellington	77	22	46.2	2.62	T.
Willoughby				2.07	
Wooster	76	21	45.7	3.29	0.2
Zanesville				4.49	
Oklahoma.					
Beaver	80	−12	43.4	0.27	
Blackburn	81	12	48.4	4.38	1.0
Burnett	80	18	50.7	1.96	
Chandler	80	16	50.7	2.66	
Cleo	79	8	48.6	1.15	
Clifton	90	12	48.2	3.28	0.8
Cloud Chief	81	13	48.4	1.05	
Enid	77	14	47.6	2.15	
Fort Reno	82	15	48.4	4.10	
Fort Sill	76	21	49.4	2.22	0.2
Guthrie	79	17	47.6	3.23	1.0
Hennessey	80	14	48.0	2.22	
Jenkins	80	6	46.2	1.02	
Kenton	81	−13	42.0	0.10	0.5
Kingfisher	82	17	48.6	2.83	
Mangum	82	17	51.8	1.36	
Newkirk	76	15	47.6	2.38	
Norman	80[f]	18[e]	50.3[e]	2.22	1.5
Pawhuska	79	15	48.4	5.05	0.5
Perry	78	16	48.4	2.58	0.1
Sac and Fox Agency	80	24	53.4	4.26	0.2
Shawnee	82	18	52.2	2.12	
Stillwater	78	16	49.9	3.66	0.3
Taloga	84	24	48.6	2.15	
Temple	79	21	51.2	1.38	T.
Ural	82	9	46.9	2.71	0.1
Waukomis	79	16	48.4	2.03	
Weatherford	82	13	48.4	0.84	
Oregon.					
Albany *b*				2.92	
Alpha	73	23	44.8	6.82	
Arlington	74	24	44.8	0.61	1.0
Ashland	69	26	44.6	2.28	5.7
Astoria	62	30	44.7	9.48	0.8
Aurora (near)	70	24	44.3	3.06	T.
Bay City	64	27	43.2	12.28	0.3
Bend	66	15	35.8	1.02	9.0
Beulah	65	8	38.6	1.36	4.0
Blackbutte	67	24	43.2	6.30	
Blalock	75	25	46.6	0.34	0.1
Bullrun				4.87	
Cascade Locks	67	28	44.4	3.89	T.
Coquille				9.03	
Corvallis	70	24	44.4	2.68	T.
Dayville	74	17	42.4	1.16	9.0
Doraville	70	24	41.6	5.90	7.0
Drain	76	26	47.4	4.02	
Ella				0.68	T.
Eugene	67[b]	27[b]	42.6[b]	3.64	
Fairview	72	28	46.4	6.41	2.0
Falls City	68	25	41.4	9.74	
Forestgrove	64	22	42.8	5.69	
Gardiner	72	30	48.4	9.58	
Glenora	77	23	41.7	14.93	13.0
Government Camp	62[e]	3[e]	32.0[e]	3.71[e]	19.0
Grants Pass	78	22	45.8	4.72	
Grass Valley	68	15	38.3	0.57	0.5
Heppner	72	17	43.4	0.99	5.0
Hood River (near)	71	23	43.0	2.50	T.
Huntington	64	11	42.7	1.93	8.0
Jacksonville	76	22	49.0	4.64	
Joseph	58	12	34.0	1.96	15.0
Kerby	74	21	44.3	9.79	T.
Klamath Falls	67	8	37.8	1.18	1.5
Lagrande	60	13	37.9	0.79	10.0
Lakeview	62	−2	34.4	1.93	8.1
Lonerock	68	13	37.3	1.61	17.3
McKenzie Bridge	77	21	43.8	5.88	4.0
McMinnville	70	26	44.6	3.69	0.4
Monroe	69	23	44.5	4.96	T.
Mount Angel	69	26	44.3	3.41	
Nehalem				10.81	1.0
Newport	65	30	45.8	7.59	
Pendleton	75	18	42.5	1.35	4.0
Placer				4.50	0.5
Riverside				1.02	4.0
Salem	67	29	45.3	2.73	
Silverlake	70	5	37.4	1.15	7.5
Sparta	56	9	34.8	3.10	13.0
Stafford	70	24	43.6	3.84	2.0
The Dalles	70	25	45.2	0.56	1.4
Toledo	74	27	46.0	7.59	
Umatilla	76	22	46.3	0.28	T.
Vale	68	18	40.8	1.43	5.0
Wallowa	65	14	37.8	1.99	10.1
Wamic	68	15	39.3	1.03	7.0
Warm Spring	71	21	42.3	0.80	5.5
Weston	69	10	39.3	1.83	15.5
Williams	72	20	45.0	5.28	T.
Pennsylvania.					
Aleppo	78	21	49.6	4.81	
Altoona	77	20	46.0	4.38	
Athens	76	29	43.3	4.33	T.
Beaver Dam				4.34	
Bellefonte	80	22	49.4	4.16	
Brookville				5.62	
Browers				3.66	
Butler	74	20	46.6	4.38	
California	83	22	50.5	3.98	0.1
Cassandra	75	18	44.8	3.47	4.0
Centerhall	74	21	46.2	3.90	
Clarion				5.66	T.
Coatesville	74	23	48.4	3.60	
Coudersport				4.25	
Confluence				3.06	1.9
Davis Island Dam				4.99	
Derry Station	79	20	48.6	4.02	0.5
Doylestown				4.98	
Dushore	69	17	41.6	3.36	T.
Dyberry	71	14	41.2	5.11	T.
East Bloomsburg				2.81	
East Mauch Chunk	75	20	46.2	5.50	
Easton	68	25	46.8	4.44	
Ellwood Junction				4.50	T.
Emporium	77	20	45.7	4.84	T.
Ephrata	70	22	47.8	3.87	
Everett	73[e]	22[e]	45.9[e]	4.07	
Forks of Neshaminy				3.88	
Franklin	78	19	48.8		
Freeport	79	21	49.6	4.95	T.
Girardville				4.72	
Grampian	76	17	45.7	4.89	T.
Greensboro				4.32	T.
Greenville	79	21	46.0	5.10	1.0
Hamburg	70	20	47.2	4.54	
Hamlinton	72	18	41.8	5.34	
Herrs Island Dam				5.12	
Huntingdon *a*				3.94	
Huntingdon *b*	77	21	48.0	4.13	
Indiana	75	19	47.8	4.40	
Irwin	80	19	49.0	5.05	T.
Johnstown	80	23	48.6	3.72	T.
Keating				4.67	T.
Kennett Square	71	19	47.4	3.89	T.
Lansdale				3.08	
Lawrenceville	80	19	42.8	4.67	
Lebanon	70	22	47.8	4.65	T.
Leroy	73	19	42.2	4.37	T.
Lewisburg	71	23	46.2	3.32	
Lockhaven *a*	80	22	48.2	3.97	
Lockhaven *b*				4.06	T.
Lock No. 4				4.72	0.2
Lycippus	79	21	48.1	3.42	
Mifflin				3.71	
Milford	71	15	45.1	4.42	T.
Oil City				5.06	0.5
Ottsville				3.98	
Parker				5.52	T.
Philadelphia	72	29	50.3	4.93	
Pocono Lake	67[e]	17[e]	40.6[e]	5.58	
Point Pleasant				4.55	
Pottsville				5.81	
Quakertown	73	23	47.8	4.02	
Reading	72	25	48.8	4.42	
Renovo *a*	78	22	46.0	4.59	
Renovo *b*				4.45	
Saegerstown	78	16	44.9	4.44	T.
St. Marys	74[d]	18[d]	42.6[d]	2.50	0.5
Saltsburg				3.97	0.4
Seisholtzville				4.74	
Selinsgrove	71	25	47.6	3.29	
Shawmont				4.16	
Smethport	75	18	43.5	4.00	T.
Smiths Corners				4.59	
Somerset	80	18	45.4	4.84	
South Bethlehem	72	26	47.6	4.87	
South Eaton	71	20	45.5	4.83	
Spring Mount				3.53	
State College	72	21	44.9	4.18	
Sunbury				4.10	
Swarthmore	73	24	48.3	4.62	
Towanda	75	21	43.9	3.83	T.
Troutrun				5.56	
Uniontown	80	28	51.2	3.84	2.0
Warren	76	18	43.7	4.09	0.3
Wellsboro	75	20	45.1	5.19	T.
Westchester	72	24	48.6	4.09	
West Newton				4.80	T
Wilkesbarre	73	21	45.8	4.33	
Williamsport	70	25	47.8	3.96	
York	73	25	48.9	4.72	T.
Rhode Island.					
Bristol	57	24	43.4	6.90	
Kingston	68	16	42.6	9.19	
Pawtucket	73	25	46.8	6.28	
Providence *a*	71	25	47.0	8.17	T.
Providence *c*	71	20	44.1	8.38	
South Carolina.					
Allendale	80	38	62.2	7.90	
Anderson	77	31	57.8	5.65	
Barksdale	74[1]	30[1]	55.2[1]	6.30	
Batesburg	82	31	60.3	11.14	
Beaufort	80	38	63.9	6.31	
Bennettsville	83	34	61.6	4.63	
Blackville	82	38	62.4	3.47	
Bowman	83	36	62.5	1.53	
Calhoun Falls				6.93	
Camden				6.44	
Cheraw *a*	79	34	60.2	5.01	
Cheraw *b*				5.40	
Clarks Hill	80	35	61.2	7.31	
Clemson College	76	26	56.6	8.21	
Conway	80	38	62.8	5.59	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
South Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Darlington	81	35	61.2	3.80	
Duewest	75	33	59.0	7.01	
Edisto	.....	.....	.....	4.59	
Effingham	.....	.....	.....	6.28	
Florence	80	37	61.0	8.74	
Gaffney	80	28	56.8	9.42	
Georgetown	80	42	63.8	6.00	
Gillisonville	82	37	62.8	4.08	
Greenville	78	28	54.3	7.35	
Greenwood	78	32	57.6	6.46	
Heath Springs	80	31	57.7	5.38	
Kingstree [b]	.....	.....	.....	5.80	
Liberty	77	28	57.0	7.56	
Little Mountain	81	32	60.3	8.73	
Longshore	80	33	59.6	8.03	
Pinopolis [*1]	82	41	62.2	3.71	
St. Stephens	.....	.....	.....	5.53	
Saluda [c]	82	32	62.4	6.80	
Santuck	80	27	57.9	8.19	
Seivern	84	31	60.4	3.19	
Smiths Mills	.....	.....	.....	6.17	
Society Hill	79	36	60.8	3.37	
Spartanburg	77	27	56.2	8.68	
Statesburg	82	36	62.2	4.25	
Summerville	82	39	62.5	3.09	
Sumter	80	39	62.4	4.10	
Temperance	78[d]	37[d]	59.8[d]	7.05	
Trenton	78	35	60.6	7.57	
Trial	81	38	62.1	4.40	
Winnsboro	78	33	59.2	6.56	
Winthrop College	78	30	58.4	7.38	
Yorkville	80	32	59.2	9.18	
South Dakota.					
Aberdeen	62	1	29.4	1.42	5.5
Academy	71	4	32.7	1.23	0.8
Alexandria	72	5	32.5	1.25	
Armour	68	10	32.6	2.06	0.5
Ashcroft	74	3	32.0	0.50	5.0
Bowdle	63	3	27.2	0.20	2.0
Brookings	63	5	30.6	1.87	
Canton	68	10	34.6	2.31	
Cavite	78	1	33.5	1.00	
Centerville	.....	.....	.....	2.23	3.4
Chamberlain	77	4	33.1	0.58	1.2
Cherry Creek	75	−7	31.2	0.65	
Clark	64	−4	27.4	1.25	T.
Doland	63	0	29.8	1.46	2.3
Elkpoint	69	11	36.6	1.75	0.5
Fairfax	67	4	34.8	0.00	
Farmingdale	.....	.....	.....	0.49	T.
Faulkton	62	−1	26.6	0.97	5.0
Flandreau	62	7	31.5	1.51	0.7
Forestburg	67	3	30.9	1.55	T.
Fort Meade	72	−7	31.8	1.70	16.0
Gannvalley	68	2	31.2	0.80	1.0
Gary	63	6	29.4	2.26	
Grand River School	73	−6	29.4	0.27	8.0
Greenwood	73	11	35.8	0.86	T.
Highmore	.....	.....	.....	0.87	4.5
Hotch City	76	−3	30.2	0.36	0.3
Howard	69	3	33.2	1.21	0.1
Howell	64	−3	28.0	1.10	3.0
Interior	73	0	33.6	0.40	4.0
Ipswich	58	−5	26.0	0.40	3.0
Kimball	67	4	31.4	1.23	2.0
Leola	60	.....	.....	0.50	6.0
Marion	68	9	33.8	1.78	
Mellette	63	−1	28.9	0.32	T.
Menno	70	6	33.7	1.65	0.5
Millbank	60	3	29.3	1.23	
Mitchell	70	5	32.0	0.99	T.
Oelrichs	72	−12	31.9	1.25	12.5
Pedro	71	−15	31.5	0.43	
Pine Ridge	71	−9	33.6	0.20	3.0
Plankinton	67	5	35.6	0.87	1.0
Ramsey	65	4	31.6	1.25	T.
Redfield	66	1	26.0	1.44	4.5
Rosebud	74	0	33.2	0.53	2.5
Silver City	.....	.....	.....	1.82	16.0
Sioux Falls	67	8	32.6	2.13	
Sisseton Agency	55	0	27.2	0.74	2.0
Spearfish	66	−1	29.7	3.98	29.5
Tyndall	73	7	34.1	0.70	
Vermilion	71	10	35.8	2.36	T.
Watertown	63	1	28.7	0.53	0.3
Waubay	56	−12	27.6	0.95	
Wentworth	66	4	31.6	1.29	
Wolsey	.....	.....	.....	1.18	1.2
Tennessee.					
Andersonville	80	25	54.8	7.91	
Ashwood	77	27	54.8	5.74	
Benton	79	25	56.8	8.74	
Bluff City	.....	.....	.....	4.56	
Bolivar	79	22	54.6	3.66	
Bristol	78	21	52.8	4.12	T.
Byrdstown	79	23	54.5	6.91	
Carthage	82	30	56.9	6.73	
Callettsburg	.....	.....	.....	8.06	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Tennessee—Cont'd.	°	°	°	*Ins.*	*Ins.*
Charleston	.....	.....	.....	8.66	
Clarksville	78	28	53.7	5.25	
Clinton	.....	.....	.....	7.60	
Covington	78	28	53.6	4.73	
Decatur	78	26	56.2	12.12	
Dickson [i]	77	26	55.0	2.18	
Elizabethton	78	23	55.3	4.77	
Erasmus	75	19	52.8	6.38	T.
Florence	76	27	54.5	5.17	
Franklin	80	28	54.4	5.22	T.
Grace [*1]	80	28	58.0	7.24	
Greeneville	76	22	54.0	5.94	T.
Halls Hill	.....	.....	.....	6.00	
Harriman	78	26	54.2	6.93	
Hohenwald	78	23	53.2	5.14	
Iron City	77	24	55.2	5.66	
Isabella	71	28	53.8	7.94	T.
Jackson	79	26	55.2	3.47	
Johnsonville	80	25	54.6	6.51	
Jonesboro	77	23	54.4	6.77	
Kenton	80	28	54.4	5.45	T.
Kingston	.....	.....	.....	6.84	
Leadvale	.....	.....	.....	5.64	
Lebanon	78	26	53.6	6.27	
Lewisburg	78	27	54.8	4.02	
Liberty	83	.....	.....	6.20	
Lynnville	77	30	55.8	4.26	
McKenzie	81	32	56.4	4.67	
McMinnville	78	25	55.5	6.79	T.
Maryville	78	27	56.0	8.14	
Newport	81	27	56.4	5.87	
Nunnelly	79	24	54.0	4.52	
Oakhill	76	25	55.5	7.64	
Palmetto	77	29	55.7	5.58	
Pope	81	23	55.6	4.56	
Rogersville	81	24	56.0	5.44	
Rugby	77	18	52.6	8.29	
Savannah	81	28	57.2	4.41	
Sewanee	72	25	53.0	5.75	
Silverlake	72	19	50.7	5.79	T.
Springdale	78	26	55.1	6.65	
Springville	80	25	54.4	5.12	T.
Tazewell	.....	.....	.....	5.87	
Tellico Plains	79	27	57.0	7.75	T.
Tracy City	73	25	54.0	5.88	
Trenton	80	27	54.8	5.05	T.
Tullahoma	78	26	55.4	5.49	
Union City	80	26	54.8	5.34	T.
Waynesboro	78	26	55.2	3.44	
Wildersville	77	30	55.4	4.67	T.
Yukon	77	30	55.8	5.32	
Texas.					
Albany	78	25	51.8	1.97	
Alvin	.....	.....	.....	7.65	
Anson	.....	.....	.....	1.15	
Arthur	.....	.....	.....	5.47	
Austin [a]	78	34	61.9	1.87	
Ballinger	82	24	52.8	0.80	0.7
Bastrop	79	32	60.7	3.10	
Beaumont	83	40	62.0	8.66	
Beeville	80	39	61.3	6.10	
Bigspring	89	22	55.0	0.24	T.
Blanco	74	30	53.6	1.99	
Boerne [*1]	78	32	55.8	2.21	
Bonham	79	25	55.4	6.38	T.
Booth	.....	.....	.....	6.14	
Bowie	82	22	52.2	2.42	T.
Brazoria	79	42	63.4	6.81	
Brenham	78	35	59.1	3.25	
Brighton	75	43	62.7	6.11	
Brownwood	88	40	61.2	1.50	
Burnet	82	28	56.8	1.86	
Camp Eagle Pass	93	24	59.0	0.25	
Childress	80	18	50.5	0.93	
Coleman	84	25	54.2	0.95	0.7
College Station	79	34	60.2	2.06	
Colorado [f]	79	26	55.8	0.98	
Columbia	76	40	62.8	9.29	
Comanche	81	24	53.1	1.43	T.
Corsicana	83	30	58.9	3.37	
Cotulla	80	42	62.6	4.26	
Cuero	86	35	61.4	3.14	
Dallas	81	27	53.8	5.14	
Danevang	79	28	61.5	7.25	
Dublin	74	24	51.8	1.93	
Duval	76	31	58.3	1.90	
Estelle	78	27	55.2	2.91	
Fort Brown	85	38	64.9	6.46	
Fort Clark	78	29	54.3	0.90	
Fort Davis	81	15	51.2	T.	T.
Fort McIntosh	93	36	60.5	2.44	
Fort Ringgold	91	36	65.0	2.00	
Fort Stockton	.....	.....	.....	0.04	
Fredericksburg	84	30	56.0	2.21	
Gainesville	79	24	53.1	2.41	0.2
Gatesville	90	31	57.5	1.96	
Georgetown	78	30	57.0	2.46	
Grapevine	77	26	54.7	1.48	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Texas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Greenville	81	30	57.4	3.60	
Hale Center	85	18	50.7	T.	T.
Hallettsville	79	36	62.4	2.73	
Haskell	85	22	53.4	1.29	
Hearne	84	32	63.8	2.56	
Henrietta	77	21	52.0	2.70	1.0
Hewitt	.....	.....	.....	3.05	
Hondo	.....	.....	.....	2.36	
Houston	82	40	62.2	6.80	
Huntsville	79	35	58.0	5.67	
Ira	88	21	53.0	0.47	T.
Jacksonville	78	29	58.2	3.76	T.
Jasper	80	37	62.4	7.60	
Junction	.....	.....	.....	0.71	T.
Kaufman	88	29	58.0	4.51	
Kent	.....	.....	.....	0.05	T.
Kerrville	.....	.....	.....	0.30	
Kopperl	.....	.....	.....	3.43	
Lampasas	84	28	54.8	3.64	
Lapara	.....	.....	.....	6.57	
Laureles Ranch	.....	.....	.....	6.84	
Llano	.....	.....	.....	0.60	T.
Longview	80	31	58.6	3.62	
Luling	78	32	58.8	1.55	
Mann	80	30	57.9	4.41	
Marlin	85	32	56.4	2.33	
Menardville	79	24	52.6	0.76	
Mount Blanco	83	17	49.7	T.	T.
Nacogdoches	80	34	58.7	5.05	
New Braunfels	77	35	59.4	1.38	
Panter	.....	.....	.....	1.96	
Pearsall	82	38	60.6	2.75	
Port Lavaca	79	40	62.9	5.43	
Rhineland	82	21	51.0	1.46	
Rockisland	78	40	62.1	3.62	
Rockport	69	39	55.6	11.21	
Runge	82	37	61.2	3.13	
Sanderson	75	33	56.3	0.10	
San Marcos	78	34	59.1	2.60	
San Saba	62	27	55.4	1.28	T.
Sherman	70	26	52.6	3.25	T.
Sonora	89	26	55.3	0.56	T.
Sugarland	80	42	64.2	8.16	
Sulphur Springs	80	27	57.0	5.22	
Temple [a]	76	28	54.8	3.21	
Temple [b]	77	28	55.6	2.96	
Trinity	80	33	60.8	6.64	
Tyler	81	29	57.3	4.18	
Victoria	79°	38°	62.6°	4.17	
Waco	85	30	57.8	2.90	
Waxahachie	.....	.....	.....	4.61	
Weatherford	77	25	53.4	2.17	
Wharton	78	38	62.4	5.40	
Wichita Falls	.....	.....	.....	2.30	1.0
Utah.					
Aneth	71	17	44.8	1.54	
Blackrock	70	−1	38.8	2.00	16.5
Bluecreek [*1]	70	10	42.8	0.30	2.0
Castledale	74	−1	36.2	0.57	
Cisco	60	8	39.9	1.00	
Corinne	68	4	39.5	1.06	2.5
Deseret	71	−9	39.6	0.40	4.0
Emery	63	5	35.1	0.26	2.6
Farmington	65	11	40.6	1.59	12.7
Fillmore	71	4	41.1	1.19	
Fort Duchesne	62	−12	28.3	0.08	0.8
Frisco	64	14	37.7	0.68	
Garrison	72	8	40.8	0.20	2.0
Giles	67	8	37.3	0.26	
Government Creek	62	2	36.4	2.12	15.1
Green River	75	18	46.2	0.02	0.2
Grover	61	0	35.0	0.36	T.
Heber	62	−10	33.3	1.95	
Henefer	64	−14	32.7	1.93	15.2
Hite	75	18	48.6	0.64	
Huntsville	.....	.....	.....	2.01	18.0
Ibapah	68	−8	36.2	1.12	0.1
Kanab	65	20	43.8	5.55	2.0
Kelton	65	1	35.2	0.40	4.0
La Sal	55	11	34.4	1.01	T.
Levan	62	2	35.2	1.33	12.4
Loa	59	0	29.4	0.41	2.0
Logan	64	−3	36.2	0.52	
Lund	66	10	39.0	1.20	3.6
Manti	62	3	35.5	1.16	9.5
Marysvale	63	0	36.8	0.66	6.6
Meadowville	48	−21	21.9	1.25	13.5
Millville	.....	.....	.....	1.69	
Minersville	67	5	39.2	1.10	13.0
Moab	70	14	45.0	0.91	T.
Monticello	81	5	35.8	2.61	15.0
Morgan	71	−9	34.8	1.14	9.2
Mount Nebo	65	3	38.6	1.61	7.5
Mount Pleasant	60	11	37.4	1.40	14.0
Ogden [a]	67	7	39.6	1.38	11.0
Park City	62	0	33.0	2.60	24.5
Parowan	64	1	38.0	1.94	16.3
Pinto	59	−9	34.0	1.57	19.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Utah—Cont'd.	°	°	°	*Ins.*	*Ins.*
Plateau	56	−17	30.7	1.02	11.5
Promontory				0.73	2.8
Provo	68	7	40.6	1.80	11.3
Ranch	58	− 5	29.6	4.31	
Richfield	68	9	40.4	0.57	3.0
St. George	80	12	48.7	0.99	
Scipio	66	0	38.2	1.59	6.0
Snowville	63	−10	35.3	0.57	
Soldier Summit	52			0.20	2.0
Terrace	68	4	37.9	0.75	7.5
Thistle	67	5	38.1		
Tooele	70	9	40.6	1.80	
Tropic[m]	62	19	40.0	0.32	1.0
Vernal	64	− 5	33.5	1.02	6.9
Wellington	65[e]	3[e]	36.0[e]	0.76	2.5
Woodruff	59[f]	−32	19.8[e]	0.90	9.0
Vermont.					
Bellows Falls				5.00	0.5
Burlington	70	8	40.0	3.53	1.0
Cavendish	74	13	39.8	4.28	3.9
Chelsea	65	5	35.2	5.03	8.0
Cornwall	72[f]	7[f]	41.4[f]	3.79	3.0
Enosburg Falls	74	− 4	36.9	5.08	5.0
Jacksonville	71	9	37.9	5.78	8.0
Manchester	70	17	41.0	3.54	4.6
Morrisville	76	− 5	38.0	7.58	6.9
Norwich	74	10	37.8	4.43	2.0
St. Johnsbury	75	− 1	38.8	5.13	1.5
Wells	68	12	38.8	6.45	3.0
Wells River				4.93	
White River Junction				4.90	0.5
Woodstock	73	9	40.9	4.33	
Virginia.					
Alexandria	75	32	51.2	5.45	
Ashland	76	23	53.2	5.20	
Barboursville	81	24	54.0	5.26	T.
Bedford	79	29	53.6	5.63	T.
Bigstone Gap	81	22	54.8	5.06	
Blacksburg	72	22	47.2	5.68	0.5
Bluemont[j]	72	31	54.0	3.75	T.
Bonair	75	25	53.1	6.27	
Boykins				5.50	
Buckingham	78	23	52.0	6.88	
Burkes Garden	68	16	46.8	6.56	
Callaville	76	26	52.0	9.85	
Charlottesville	74	24	52.9	4.51	T.
Clarksville				7.14	
Columbia	77	16	51.1	5.00	
Dale Enterprise	74	19	49.6	4.06	0.5
Danville				5.80	
Fredericksburg	78	20	52.0	7.31	
Hampton	75	32	53.8	5.61	
Hot Springs	73	17	48.0	5.03	
La Crosse	76	27	55.5	7.80	
Lexington	78	20	52.0	5.45	
Lincoln	74	22	49.7	3.95	
Manassas	74	23	49.6	6.28	
Marion	76[e]	19[e]	52.6[e]	4.75	
Mendota				5.37	
Newport News	78	30	54.0	5.95	
Petersburg	77	25	53.7	8.11	T.
Quantico	69	22	50.2		
Radford				3.20	
Riverton				3.29	
Roanoke	72	22	50.3	7.25	1.5
Rockymount	71	22	49.3	7.64	
Saxe	78	18	33.5	6.39	T.
Shenandoah				4.05	T.
Speers Ferry				6.18	
Spottsville	78	26	53.8	6.71	T.
Stanardsville	74	23	52.7	5.13	
Staunton	74	25	52.1	4.93	2.0
Stephens City	77	21	50.3	3.63	
Warsaw	78	20	53.1	6.56	
Westpoint	76	20	51.6	6.35	T.
Wilkerson	76	23	51.9	5.92	
Williamsburg	74	27	53.0	6.37	
Woodstock	76	21	50.6	3.65	T.
Wytheville	75	22	50.5	5.08	4.0
Washington.					
Aberdeen	70	27	48.0	6.98	3.0
Anacortes				3.46	4.0
Ashford				7.85	17.0
Blaine	58	21	39.2	3.58	6.5
Bremerton	65	21	40.4	7.97	13.0
Brinnon	65	24	41.4	10.72	10.2
Cedonia	57	8	33.8	1.99	7.0
Centralia	74	18	42.0	6.98	4.0
Cheney				0.70	4.5
Clearbrook	67	16	39.8	4.88	10.0
Clearwater	65	25	41.2	8.78	
Cle Elum	62	11	35.2	1.38	T.
Colfax	67	20	40.8	1.22	
Colville	67	8	37.4	1.61	0.1
Conconully	58	− 2	31.2	1.14	3.7
Connell				0.25	1.0
Coupeville	67	25	41.2	3.38	4.8
Crescent	64	12	35.8	1.26	4.0
Washington—Cont'd.					
Dayton	72	24	42.3	2.82	9.2
East Sound	59	21	39.1	4.58	7.0
Ellensburg	68	17	39.0	0.27	T.
Grandmound	73	14	40.6	7.08	2.5
Granite Falls				4.10	6.0
Hooper	73	22	42.6	0.85	1.0
Ilwaco	67	24	43.0	8.19	0.5
Lacenter	70	22	42.0	5.25	1.2
Lakeside	56	17	37.0	0.88	1.0
Lind	70	20	41.5	1.23	3.0
Loomis	58	11	35.2	1.70	7.0
Mayfield[m]	71	20	41.1	5.10	5.0
Mottinger Ranch	78	25	46.3	0.45	0.0
Mount Pleasant	69	25	44.5	3.58	4.0
Moxee	70	16	41.2	0.42	T.
Odessa	65	13	37.4		0.5
Olga	56	25	40.8	3.50	5.5
Olympia	71	20	42.5	7.77	1.0
Pinehill	68	18	42.8	1.36	3.0
Pomeroy	73	21	42.1	1.81	7.8
Port Townsend	61	28	41.4	2.52	4.3
Pullman	66	21	38.2	2.08	7.8
Rattlesnake Mountains	63[b]	20[b]	35.3[b]	1.21	2.0
Republic	62	0	34.0	1.68	5.5
Ritzville				0.37	2.5
Ritzville (near)				0.89	2.0
Rosalia	64	21	37.3	1.68	4.8
Sedro-Woolley	69	21	41.6	5.28	10.0
Silvana	65	18	40.4	2.49	8.0
Snohomish	61	20	40.8	4.88	11.0
Snoqualmie	69	27	42.4	4.30	T.
Southbend	70	22	42.6	9.68	4.0
South Ellensburg	66	16	37.5	1.01	2.0
Sprague				0.30	
Sunnyside	70	17	42.4	0.31	0.3
Trinidad	67	20	42.2	0.25	
Union	68	22	41.8	8.69	8.4
Usk	63[c]	3[c]	34.2[c]	3.22	6.5
Vancouver	75	26	44.9	4.07	2.0
Vashon	65	27	41.5	5.96	
Waterville	50	4	29.8	0.63	2.0
Wenatchee (near)	60	14	37.4	1.23	8.0
Whatcom	64	19	41.6	3.18	7.0
Wilbur	62	12	34.8	0.87	0.5
West Virginia.					
Bayard	73	18	45.2	4.20	1.0
Beckley	75	20	49.4	3.29	
Beverly	74	14	48.0	3.99	1.0
Bluefield		24	51.4[e]	4.53	
Buckhannon	80	20	49.9	3.93	
Burlington	83	24	48.8	2.85	0.2
Byrne	87	19	54.0	5.08	T.
Cairo	84	18[f]	55.0[d]	3.30	T.
Camden	77	22	51.2	4.37	
Central	82	18	51.0	4.00	T.
Chapel	82	20	53.1	5.94	
Charleston *a*	87	22	58.3		
Charleston *b*				4.56	
Creston	83	19	51.1	3.79	
Cuba	82	23	53.4	4.83	T.
Dayton	80	20	50.6	6.59	T.
Echo	85	20	54.4	3.62	
Elkhorn	77	21	53.2	4.96	
Fairmont				5.40	T.
Glenville	82	19	51.0	4.78	T.
Grafton	82	21	51.2	5.77	T.
Green Sulphur	78	18	50.7	3.65	
Harpers Ferry				5.24	
Hinton	76	21	53.1	4.96	
Huntington	81	21	51.8	4.38	
Leonard	70	17	47.8	5.29	T.
Lewisburg	71	19	49.2	4.58	T.
Lillydale	75	18	52.0	4.49	T.
Logan	85	23	57.4	6.10	
Magnolia	77	18	49.2	3.00	
Mannington[b]	80	26	52.4	3.40	
Martinsburg	76	22	47.4	3.35	T.
Morgantown	79	23	50.8	4.28	T.
Moscow	78	22	49.1	3.40	T.
Moundsville	81	24	51.6	3.67	T.
New Martinsville	83	25	51.4	4.85	T.
Nuttallburg	82	13	53.4	5.25	T.
Oceana	79	21	53.8	5.18	
Oldfields	79	17	49.2	2.70	T.
Philippi	80	20	50.2	5.36	T.
Pickens	78	12	49.6	6.11	2.0
Point Pleasant	84	28	51.8	4.35	T.
Powellton	83	26	55.4	4.91	
Princeton	74	20	50.6	8.20	
Romney	81	23	49.3	3.27	2.0
Rowlesburg				5.06	
Ryan	83	18	52.6	3.81	
Smithfield[e]	79	26	52.8	5.51	
Southside	81	25	54.0	4.14	
Terra Alta	76	16	45.8	4.60	1.0
Travellers Repose	72	13	45.4	5.47	1.0
Uppertract	78	21	50.3	2.96	3.0
Webster Springs	81	22	54.6	2.02	0.2
West Virginia—Cont'd.					
Wellsburg	75	22	47.4	5.20	
Weston				4.78	0.6
Wheeling *a*				3.09	0.5
Wheeling *b*	80	26	52.8	4.89	
Williamson	84	22	54.4	5.11	
Wisconsin.					
Amherst	73	3	37.0	2.19	2.0
Antigo	66	2	32.9	2.31	
Appleton	68	6	36.2	3.64	3.2
Ashland				1.98	T.
Barron	60	− 4	32.5	2.52	1.4
Beloit	72	12	40.8	2.74	T.
Brodhead	74	11	40.7	3.58	2.0
Butternut	57	− 6	30.0	3.27	5.0
Chilton	72	5	36.6	3.31	3.3
Darlington	67	8	37.3	2.14	0.2
Delavan	74	9	39.6	3.41	T.
Dodgeville	73	5	39.8		4.0
Downing	64	0	33.4	2.06	1.0
Easton	74	4	37.9	2.85	4.0
Eau Claire	62	3	36.0	2.10	2.0
Florence	62	2	32.4	4.05	6.0
Fond du Lac	72	7	40.2	1.95	T.
Grand Rapids	72	1	37.3		
Grand River Locks				3.24	4.0
Grantsburg	59	− 5	30.6	2.17	2.0
Hancock	72	3	36.6	2.85	
Harvey	74	14	39.4	2.57	2.4
Hayward	59	− 8	30.6	0.92	6.0
Hillsboro	71	3	36.4	2.35	8.0
Koepenick	64	− 5	34.9	2.50	4.0
Lancaster	73	6	38.0	1.56	6.0
Madison	68	7	38.1	3.50	3.7
Manitowoc	62	9	36.9	2.18	2.0
Meadow Valley	73	0	36.9	1.53	2.9
Medford	65	− 4	35.4	2.35	
Menasha				3.08	2.0
Neillsville	64	0	36.4	2.06	
New London	72	4	37.2	3.39	2.0
Oconto	70	6	37.9	3.61	2.5
Osceola	59	− 5	31.5	2.09	3.0
Oshkosh	72	5	38.8	3.10	1.0
Pine River	73	3	37.8	2.34	3.1
Portage	72	8	39.8	2.64	4.0
Port Washington	60	14	38.2	2.70	3.5
Prairie du Chien *a*	75	9	38.2	2.13	5.3
Prairie du Chien *b*				2.32	7.0
Racine	72	11	40.0	2.71	
Sheboygan	64	9	38.5	2.36	1.0
Spooner	59	8	30.0	2.19	4.0
Stevens Point	72	0	36.8	2.43	
Tomahawk	62	12	33.2	2.55	1.5
Valley Junction	73	4	38.2	2.24	
Viroqua	70	8	36.7	1.52	5.0
Watertown	73	17	38.4	2.22	1.7
Waukesha	73	8	39.6	2.86	2.0
Waupaca	71	3	36.8	2.48	2.0
Wausau	61	1	36.3	2.19	
Whitehall	67	2	38.8	2.17	
Wyoming.					
Afton	52	−20	26.9	0.70	7.5
Alcova	58[l]	7	32.5[f]	0.62	10.0
Basin	72	− 4	34.0	T.	T.
Bedford	52	−19	27.5	0.54	
Border	50	−33	19.2	1.13	
Buffalo	68	0	31.0	0.49	3.5
Centennial	47	−13	23.9	1.24	10.9
Chugwater	68	−12	32.8	0.97	9.0
Daniel	48	−30	17.0	0.80	8.0
Evanston	52	−11	25.2	0.44	7.0
Fort Laramie	70	7	35.0	1.31	19.0
Fort Washakie	66	− 9	30.8	1.80	18.0
Fort Yellowstone	54	− 3	28.6	0.85	7.0
Fourbear	58	− 8	27.0	0.66	6.7
Griggs	66	1	33.4	0.46	4.6
Hyattville	70	2	34.2	0.75	7.5
Irma	66	− 1	32.8	0.10	1.0
Iron Mountain	60	− 3	32.2	0.77	
Kimball Ranch	67	4	29.6	0.09	0.8
Laramie	58	− 8	29.3	1.09	8.0
Leo	55	− 4	29.0	0.62	2.5
Lolabama Ranch	55	− 6	26.2	0.29	5.0
Lusk	63	− 3	29.6	1.10	11.0
Moorcroft	65	−16	29.4	1.25	4.0
Moore	60	4	32.9	1.12	22.2
Parkman	68[d]	− 2[d]	27.4[d]	0.28	
Pinebluff	67	3	32.4	0.40	4.0
Rawlins	53	− 2	29.8	1.42	13.2
Red Bank	63	0	31.2	2.05	
Rocksprings	60	1	30.2	0.40	4.0
Saratoga	57	− 8	30.6	2.45	23.0
South Pass City	52	−15	21.0	2.60	26.0
Thayne	47	−23	25.4	0.63	3.8
Thermopolis	68	−11	23.4	1.72	16.0
Porto Rico.					
Adjuntas	88	44	70.2	1.29	
Aguadilla	91	63[d]	76.6	4.67	
Aguirre	88	61	76.4	0.59	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.	
Porto Rico—Cont'd.	°	°	°	*Ins.*	*Ins.*	
Arecibo	87	56	73.4	4.74		
Barros	86	51	69.8	1.55		
Bayamon	90	56	74.4	2.73		
Caguas	90	54	74.0	1.80		
Canovanas	88	67	77.3	1.34		
Cayey	86	54	70.5	0.85		
Cidra	86	50	70.1	4.80		
Coamo	92	56	75.8	T.		
Corozal	90	54	71.2	2.21		
Fajardo	86	62	76.6	2.24		
Guanica	92	56	74.4	1.77		
Hacienda Coloso	90	52	72.8	2.34		
Hacienda Josefa	.....	.....	.....	1.79		
Hacienda Perla	88	62	76.4	3.73		
Humacao	90	70	79.3	1.21		
Isabela	85	59	73.0	3.23		
Juan Diaz	89	58	76.7	0.30		
La Carmeleta	85	59	72.1	1.32		
La Isolina	90	58	72.8	5.57		
Las Marias	90	61	75.5	1.82		
Manati	93	58	75.0	3.25		
Maunabo	88	59	75.4	2.69		
Mayaguez	92	59	75.5	2.19		
Morovis	88	56	70.8	6.13		
Ponce	89	60	76.2	0.18		
Rio Piedras	.....	.....	.....	3.11		
San German	90	64	77.4	1.89		
San Lorenzo	90	53	73.1	1.99		
San Salvador	88	56	71.2	1.70		
Santa Isabel	89	58	75.8	0.76		
Utuado	89	56	72.8	1.82		
Vieques	88	64	77.5	0.87		
Yauco	86	60	74.6	3.80		
Mexico.						
Ciudad P. Diaz	87	39	60.4	0.30		
Coatzacoalcos	83	60	72.2	4.19		
Leon de Aldamas	86	42	63.5	0.49		
Vera Cruz	85	63	73.0	.....		
New Brunswick.						3.6
St. John	48	5	34.0	7.66		
Isthmus of Panama.						
Alhajuela	95	64	80.8	0.39		
Bohio	.....	.....	.....	1.22		
Colon	.....	.....	.....	0.98		
Gamboa	.....	.....	.....	0.32		
La Boca	89	72	80.7	0.04		
Ontario.						
Peterboro	.....	.....	.....	1.60	1.0	
Late reports for February, 1903.						
Alaska.						
Coal Harbor	45	−10	29.6	7.32	20.2	
Fort Egbert	37	−55	3.0	0.81	5.4	
Fort Yukon	.....	.....	.....	1.09	.....	
Juneau	42	7	31.2	7.29	18.0	
Kenai	42	−46	18.2	2.18	35.8	
Orca	.....	.....	.....	16.60	32.0	
Wood Island	54	0	29.3	8.10	12.8	
Arizona.						
Pinal Ranch	.....	.....	.....	1.32	0.4	
California.						
Newcastle	74	26	44.9	1.95	T.	
Tulare *b*	.....	.....	.....	0.65		
Ventura	78	29	53.6	1.08		
Colorado.						
Montrose	.....	.....	.....	0.95	14.0	
Connecticut.						
Southington	57	−11	29.0	4.29	9.0	
Idaho.						
Roosevelt *b*	43	−14	16.0	1.18	9.6	
Maryland.						
Pocomoke City	68	9	41.2	3.92		
Montana.						
Fort Benton	46	−10	17.6	0.70	7.0	
Nebraska.						
Tecumseh *c*	.....	.....	.....	1.07	6.1	
New Jersey.						
Hanover	64	− 5	30.0	5.08	10.5	
Oregon.						
Government Camp	57	4	29.2	3.30	20.0	
South Dakota.						
Gary	37	−26	4.5	.....	.....	
Texas.						
Anson	.....	.....	.....	3.00		
Temple *b*	76	14	45.4	4.98	T.	
Vermont.						
Hartland	56	−26	22.0	3.77	21.5	
West Virginia.						
Weston *a*	.....	.....	.....	6.55	6.2	
Porto Rico.						
Barros	85	50	69.8	1.62		
H. Colosa	91	55	72.4	0.65		

EXPLANATION OF SIGNS.

*Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. ÷ 4.
[2] Mean of 8 a. m. + 8 p. m. ÷ 2.
[3] Mean of 7 a. m. + 7 p. m. ÷ 2.
[4] Mean of 6 a. m. + 6 p. m. ÷ 2.
[5] Mean of 7 a. m. + 2 p. m. ÷ 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance "[a]" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks, of whatever duration, in the precipitation record receive appropriate notice.

CORRECTIONS.

December, 1902, Oregon, Grass Valley, make minimum and mean temperatures read 16 and 29.1 instead of −6 and 28.8, respectively.

TABLE III.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of March, 1903.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	20	17	16	27	n. 75 w.	11
Portland, Me	20	21	11	24	s. 86 w.	13
Concord, N. H	12	8	12	9	n. 45 e.	4
Northfield, Vt	18	37	4	10	s. 18 w.	20
Boston, Mass	21	16	17	21	n. 39 w.	6
Nantucket, Mass	18	23	17	21	s. 39 w.	6
Block Island, R. I	14	24	19	20	s. 6 w.	10
Narragansett, R. I *	11	12	7	8	s. 45 w.	1
New Haven, Conn	23	20	16	18	n. 34 w.	4
Middle Atlantic States.						
Albany, N. Y	28	23	5	18	n. 69 w.	14
Binghamton, N. Y.†	13	6	11	7	n. 30 e.	8
New York, N. Y	14	20	21	18	s. 27 e.	7
Harrisburg, Pa	17	19	25	13	s. 81 e.	12
Philadelphia, Pa	17	17	24	18	e.	6
Scranton, Pa	24	17	20	18	n. 16 e.	7
Atlantic City, N. J	16	20	19	23	s. 45 w.	6
Cape May, N. J	20	23	19	14	s. 59 e.	6
Baltimore, Md	16	20	21	14	s. 60 e.	8
Washington, D. C	17	22	21	10	s. 66 e.	12
Cape Henry, Va	12	10	12	7	n. 68 e.	5
Lynchburg, Va	25	12	23	19	n. 17 e.	14
Norfolk, Va	24	20	25	7	n. 77 e.	18
Richmond, Va	21	21	23	11	e.	12
Wytheville, Va	18	14	22	22	n.	4
South Atlantic States.						
Asheville, N. C	21	22	22	11	s. 85 e.	11
Charlotte, N. C	21	21	27	7	e.	20
Hatteras, N. C	22	19	24	10	n. 78 e.	14
Kittyhawk, N. C	12	10	13	7	n. 72 e.	6
Raleigh, N. C	24	13	28	13	n. 54 e.	19
Wilmington, N. C	21	20	25	12	n. 86 e.	13
Charleston, S. C	24	14	28	11	n. 60 e.	20
Columbia, S. C	18	16	33	8	n. 85 e.	25
Augusta, Ga	21	15	34	11	n. 75 e.	24
Savannah, Ga	16	20	28	9	s. 78 e.	19
Jacksonville, Fla	23	15	35	8	n. 73 e.	28
Florida Peninsula.						
Jupiter, Fla	19	14	37	7	n. 81 e.	30
Key West, Fla	10	12	43	5	s. 87 e.	38
Tampa, Fla	23	8	34	11	n. 57 e.	28
Eastern Gulf States.						
Atlanta, Ga	16	25	28	10	s. 63 e.	20
Macon, Ga.†	12	5	12	6	n. 41 e.	9
Pensacola, Fla.†	11	3	22	3	n. 67 e.	21
Mobile, Ala	26	22	19	6	n. 73 e.	14
Montgomery, Ala	21	12	33	9	n. 69 e.	26
Meridian, Miss †	14	5	13	5	n. 42 e.	12
Vicksburg, Miss	25	15	27	4	n. 67 e.	25
New Orleans, La	26	14	29	6	n. 62 e.	26
Western Gulf States.						
Shreveport, La	24	7	28	7	n. 51 e.	27
Fort Smith, Ark	17	8	34	15	n. 65 e.	21
Little Rock, Ark	28	12	25	12	n. 39 e.	21
Corpus Christi, Tex	32	14	23	6	n. 43 e.	25
Fort Worth, Tex	27	18	21	9	n. 53 e.	15
Galveston, Tex	30	15	23	6	n. 48 e.	23
Palestine, Tex	26	16	26	5	n. 65 e.	23
San Antonio, Tex	27	16	30	5	n. 66 e.	27
Taylor, Tex †	19	8	8	2	n. 29 e.	12
Ohio Valley and Tennessee.						
Chattanooga, Tenn	23	19	20	14	n. 56 e.	7
Knoxville, Tenn	23	16	9	25	n. 66 w.	18
Memphis, Tenn	28	15	21	12	n. 35 e.	16
Nashville, Tenn	19	24	20	11	s. 61 e.	10
Lexington, Ky. †	8	13	13	6	s. 54 e.	9
Louisville, Ky	22	21	18	14	n. 76 e.	4
Evansville, Ind.†	12	9	11	4	n. 67 e.	8
Indianapolis, Ind	21	25	17	13	s. 45 e.	6
Cincinnati, Ohio	19	14	25	16	n. 61 e.	10
Columbus, Ohio	16	21	22	17	s. 45 e.	7
Pittsburg, Pa	20	23	17	22	s. 59 w.	6
Parkersburg, W. Va	23	19	17	16	n. 14 e.	4
Elkins, W. Va	21	21	10	20	w.	10
Lower Lake Region.						
Buffalo, N. Y	9	26	15	29	s. 39 w.	22
Oswego, N. Y	16	25	16	19	s. 18 w.	10
Rochester, N. Y	10	18	16	30	s. 60 w.	16
Syracuse, N. Y	17	22	15	23	s. 58 w.	9
Erie, Pa	19	20	13	24	s. 85 w.	11
Cleveland, Ohio	16	25	19	16	s. 18 e.	10
Sandusky, Ohio †	6	14	8	10	s. 14 w.	8
Toledo, Ohio	16	21	19	18	s. 11 e.	5
Detroit, Mich	17	21	20	19	s. 14 e.	4
Upper Lake Region.						
Alpena, Mich	17	17	17	23	w.	6
Escanaba, Mich	26	22	13	13	n.	4
Grand Haven, Mich	14	25	18	16	s. 10 e.	11
Houghton, Mich.†	8	5	9	10	n. 18 w.	3
Marquette, Mich	28	18	12	19	n. 35 w.	12
Port Huron, Mich	19	22	17	15	s. 34 e.	4
Sault Ste. Marie, Mich	10	22	23	22	s. 5 e.	12
Chicago, Ill	15	26	19	18	s. 5 e.	11
Milwaukee, Wis	18	24	16	19	s. 27 w.	7
Green Bay, Wis	15	26	19	15	s. 29 w.	12
Duluth, Minn	29	8	25	17	n. 21 e.	22
North Dakota.						
Moorhead, Minn	26	16	17	19	n. 11 w.	10
Bismarck, N. Dak	31	17	17	9	n. 30 e.	16
Williston, N. Dak	21	14	19	15	n. 30 e.	8
Upper Mississippi Valley.						
Minneapolis, Minn*	12	6	10	9	n. 9 e.	6
St. Paul, Minn	22	19	16	23	n. 60 w.	8
La Crosse, Wis. †	10	18	2	3	s. 7 w.	8
Davenport, Iowa	16	20	16	20	s. 45 w.	6
Des Moines, Iowa	16	24	15	20	s. 32 w.	9
Dubuque, Iowa	15	23	19	22	s. 21 w.	8
Keokuk, Iowa	18	25	14	18	s. 30 w.	8
Cairo, Ill	24	21	23	9	n. 78 e.	14
Springfield, Ill	19	27	13	16	s. 21 w.	8
Hannibal, Mo. †	10	12	6	9	s. 56 w.	4
St. Louis, Mo	23	26	12	13	s. 18 w.	3
Missouri Valley.						
Columbia, Mo. *	7	11	14	5	s. 66 e.	10
Kansas City, Mo	18	27	21	12	s. 45 e.	13
Springfield, Mo	18	23	26	11	s. 72 e.	16
Topeka, Kans *	9	14	7	5	s. 22 e.	5
Lincoln, Nebr	22	21	16	12	n. 76 e.	4
Omaha, Nebr	24	26	9	12	s. 56 w.	4
Valentine, Nebr	23	18	16	20	n. 39 w.	6
Sioux City, Iowa †	12	12	6	8	w.	2
Pierre, S. Dak	21	18	28	9	n. 81 e.	19
Huron, S. Dak	27	19	17	12	n. 32 e.	9
Yankton, S. Dak. †	13	10	7	13	n. 63 w.	7
Northern Slope.						
Havre, Mont	16	13	23	23	n.	3
Miles City, Mont	27	17	15	15	n.	10
Helena, Mont	21	17	7	31	n. 81 w.	24
Kalispell, Mont	16	24	11	29	s. 66 w.	20
Rapid City, S. Dak	23	13	14	24	n. 45 w.	14
Cheyenne, Wyo	22	18	5	26	n. 79 w.	21
Lander, Wyo	15	29	9	24	s. 47 w.	20
North Platte, Nebr	19	24	15	17	s. 22 w.	5
Middle Slope.						
Denver, Colo	25	22	12	11	n. 18 e.	3
Pueblo, Colo	21	15	24	18	n. 45 e.	8
Concordia, Kans	19	27	19	10	s. 48 e.	12
Dodge, Kans	21	26	14	14	s.	5
Wichita, Kans	17	31	16	9	s. 27 e.	16
Oklahoma, Okla	26	25	13	4	n. 84 e.	9
Southern Slope.						
Abilene, Tex	16	26	27	9	s. 61 e.	21
Amarillo, Tex	18	30	13	12	s. 5 e.	12
Southern Plateau.						
El Paso, Tex	17	10	20	30	n. 55 w.	12
Santa Fe, N. Mex	23	20	18	15	s. 45 e.	4
Flagstaff, Ariz	12	21	11	33	s. 68 w.	24
Phoenix, Ariz	14	11	30	15	n. 79 e.	15
Yuma, Ariz	19	14	14	23	n. 61 w.	10
Independence, Cal	12	32	9	21	s. 31 w.	23
Middle Plateau.						
Carson City, Nev	14	27	9	28	s. 56 w.	23
Winnemucca, Nev	20	18	19	21	n. 45 w.	3
Modena, Utah	10	24	11	35	s. 60 w.	28
Salt Lake City, Utah	11	31	28	11	s. 40 e.	26
Grand Junction, Colo	15	19	25	18	s. 60 e.	8
Northern Plateau.						
Baker City, Oreg	17	31	14	22	s. 30 w.	16
Boise, Idaho	10	21	25	22	s. 15 e.	11
Lewiston, Idaho †	4	12	15	8	s. 41 e.	11
Pocatello, Idaho	2	18	43	11	s. 63 e.	36
Spokane, Wash	15	25	18	16	s. 11 e.	10
Walla Walla, Wash	8	40	13	10	s. 5 e.	32
North Pacific Coast Region.						
North Head, Wash	25	14	20	19	n. 5 e.	11
Port Crescent, Wash. *	9	4	14	11	n. 31 e.	6
Seattle, Wash	27	15	20	13	n. 30 e.	14
Tacoma, Wash	27	19	13	14	n. 7 w.	8
Tatoosh Island, Wash	12	12	31	17	e.	14
Portland, Oreg	22	14	14	28	n. 60 w.	16
Roseburg, Oreg	23	18	20	15	n. 45 e.	7
Middle Pacific Coast Region.						
Eureka, Cal	14	28	15	17	s. 8 w.	14
Mount Tamalpais, Cal	7	31	11	30	s. 39 w.	31
Red Bluff, Cal	13	34	22	10	s. 30 e.	24
Sacramento, Cal	14	30	23	9	s. 41 e.	21
San Francisco, Cal	12	21	13	24	s. 51 w.	14
Point Reyes Light, Cal *	7	14	4	14	s. 55 w.	12
South Pacific Coast Region.						
Fresno, Cal	15	16	20	26	s. 80 w.	6
Los Angeles, Cal	18	9	23	26	n. 18 w.	10
San Diego, Cal	32	11	14	20	n. 16 w.	22
San Luis Obispo, Cal	18	20	4	21	s. 83 w.	17
West Indies.						
Basseterre, St. Kitts, W. I.						
Bridgetown, Barbados						
Grand Turk, W. I. †	7	4	24	0	n. 83 e.	24
Hamilton, Bermuda	20	17	35	1	n. 85 e.	34
Havana, Cuba †	1	6	27	1	s. 79 e.	26
Puerto Principe, Cuba						
San Juan, Porto Rico	10	16	41	6	s. 80 e.	36

* From observations at 8 p. m. only. † From observations at 8 a. m. only.

TABLE IV.—*Thunderstorms and auroras, March, 1903.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total No.	Total Days.	
Alabama	52	T.			2	1	2	3	1	3						2						8	3						2				27	10	T.
		A.																															0	0	A.
Arizona	56	T.				1																				7	13	2				1	24	5	T.
		A.																															0	0	A.
Arkansas	57	T.		1		3	5	13	18	2	12	4								2	14	4										78	11	T.
		A.																															0	0	A.
California	167	T.					1			1					11	1		2							2	7	3	1		1	4	4	3	41	13	T.
		A.																															0	0	A.
Colorado	81	T.									1						2	1		1							1				1	7	1	15	8	T.
		A.																															0	0	A.
Connecticut	21	T.																							1					3		1		5	3	T.
		A.																															0	0	A.
Delaware	5	T.								2														3										5	2	T.
		A.																															0	0	A.
Dist. of Columbia	4	T.																					1											1	1	T.
		A.																															0	0	A.
Florida	47	T.				3	2				1			1	1	7	8	7	2	1	2	4	9	17	10	4	5			2	3			89	19	T.
		A.																															0	0	A.
Georgia	55	T.				1	4	2	7	5	5	4					1	1			1	7	9	5	1						6			59	15	T.
		A.																															0	0	A.
Idaho	34	T.				1	1									1	1	1										1		9	3	7		25	9	T.
		A.																															0	0	A.
Illinois	92	T.				1		2	47	4								3	8	6	29	11		1									112	10	T.
		A.																															0	0	A.
Indiana	58	T.						2	22	7		1							4		2	12						1		1	1			53	10	T.
		A.																															0	0	A.
Indian Territory	11	T.						3			3									2	4													12	4	T.
		A.																															0	0	A.
Iowa	149	T.			3		1	11	11						1	1	1	30	12	21	10											1	103	12	T.
		A.																															0	0	A.
Kansas	77	T.	1					10	11		2						2	5	3	21	10									1	1			67	11	T.
		A.																													1		1	1	A.
Kentucky	41	T.						3	20	8		1						4			1	11	1										49	8	T.
		A.								1																							1	1	A.
Louisiana	46	T.		2	12	5	3	1	6	5	5	6	1		3	3					12	9	3					10	5				91	17	T.
		A.																															0	0	A.
Maine	19	T.																															0	0	T.
		A.																															0	0	A.
Maryland	48	T.							1	2	1	1					1					4	13	3	5		1			1			32	10	T.
		A.																															4	4	A.
Massachusetts	48	T.																								1							1	1	T.
		A.																															0	0	A.
Michigan	106	T.							25						1	1		4	6	33	19	13	1		1								104	10	T.
		A.																															0	0	A.
Minnesota	67	T.							1									2	9	18	3											3	36	6	T.
		A.																	1														1	1	A.
Mississippi	44	T.			2	1	3	4	8	10	8	10	1			3					3	2						3	2	2			62	15	T.
		A.																															0	0	A.
Missouri	95	T.						22	47	2	3							5	2	2	32	3		1									119	10	T.
		A.																															0	0	A.
Montana	40	T.																											4		4	1	9	3	T.
		A.																				1											1	1	A.
Nebraska	142	T.															4	12	6	27	3							2				6	60	7	T.
		A.																															0	0	A.
Nevada	40	T.																											1	2			3	2	T.
		A.																															0	0	A.
New Hampshire	19	T.																															0	0	T.
		A.																															0	0	A.
New Jersey	51	T.		1						2	2												11	2	2	4							24	7	T.
		A.																															0	0	A.
New Mexico	31	T.																									1			2			3	2	T.
		A.																															0	0	A.
New York	99	T.						1					1									3	1		1	3			5		2		17	8	T.
		A.																														1	1	1	A.
North Carolina	56	T.					5	6	6	10	6	3	1		1							12	18	8	5					1	1		83	14	T.
		A.																															0	0	A.
North Dakota	48	T.																														1	1	1	T.
		A.																													1		1	1	A.
Ohio	128	T.					1	1	51	1											1	70	1								1		127	8	T.
		A.																															0	0	A.
Oklahoma	23	T.						5	5		6								1	8	5												30	6	T.
		A.								1																							1	1	A.
Oregon	74	T.				1																				1		1	4	1	4		12	6	T.
		A.																															0	0	A.
Pennsylvania	91	T.							4								1					4	3			1					1		14	6	T.
		A.																												1			1	1	A.
Rhode Island	7	T.																							1	1							2	2	T.
		A.																															0	0	A.
South Carolina	46	T.			1		3		5	6	2	1										6	16	14	2	1							57	11	T.
		A.																															0	0	A.
South Dakota	56	T.															1	7	7	10	2						1	1			3	1	6	39	10	T.
		A.																															0	0	A.
Tennessee	56	T.					11	17	23	14	5	9	1					3			1	14	8	1		1	2	1						111	15	T.
		A.																															0	0	A.
Texas	95	T.			5	2		2	7	7	14	15								1	24	15	3					1	12				111	13	T.
		A.																															0	0	A.
Utah	47	T.					5	1										4	1							1	1			6	6	2	27	9	T.
		A.																															0	0	A.
Vermont	16	T.																								1							1	1	T.
		A.																															0	0	A.
Virginia	50	T.								11	4											5	20	10	8	1				1	4	1	65	10	T.
		A.																															0	0	A.
Washington	64	T.														1					1								8	3	6		19	5	T.
		A.																															0	0	A.
West Virginia	43	T.							7	5		5	4									12	10	3	1				1				48	9	T.
		A.																															0	0	A.
Wisconsin	60	T.						2	8		1							8	11	22	14	1											67	8	T.
		A.																															0	0	A.
Wyoming	31	T.										1							1												1	5	9	5	T.
		A.							1			1																					2	2	A.
Sums	2,893	T.	1	4	25	20	47	111	341	107	81	61	9	1	18	20	22	99	73	178	193	230	131	68	40	34	27	10	26	49	39	53	31	2149	....	T.
		A.	0	0	0	0	0	0	1	2	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	2	2	1	1	14	....	A.

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during March, 1903, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y.	23			1.19														*			
Alpena, Mich.	18			0.42														*			
Asheville, N. C.	22–23			3.64														0.46			
Atlanta, Ga.	20–21	9:22 p. m.	1:50 a. m.	1.66	9:35 p. m.	9:55 p. m.	0.10	0.06	0.29	0.41	0.53	0.55	.....	.....							
Atlantic City, N. J.	21–23			2.09														0.41			
Augusta, Ga.	21	7:42 p. m.	9:28 p. m.	1.51	8:05 p. m.	8:35 p. m.	0.11	0.09	0.26	0.55	0.82	1.07	1.11	1.14	1.18	.....	.....				
Baltimore, Md.	22–23			0.94														0.27			
Binghamton, N. Y.	22–23			0.96														0.24			
Bismarck, N. Dak.	4			0.06														*			
Block Island, R. I.	22–23			1.61														0.63			
Boise, Idaho.	14–15			0.22														0.13			
Boston, Mass.	30–31			1.51														0.47			
Buffalo, N. Y.	20			0.42														0.21			
Cairo, Ill.	6			1.09														0.41			
Charleston, S. C.	29			1.16														0.18			
Charlotte, N. C.	21–22			1.37														0.59			
Chattanooga, Tenn.	7–8			1.43														0.71			
Chicago, Ill.	6–7			0.76														*			
Cincinnati, Ohio.	7			1.01														0.67			
Cleveland, Ohio.	8			0.50														0.17			
Columbia, Mo.	7			1.60														0.62			
Columbia, S. C.	29–30			2.08														0.43			
Columbus, Ohio.	7			1.43														0.87			
Corpus Christi, Tex.	10	8:05 a. m.	6:00 p. m.	4.66	8:41 a. m. 10:24 a. m.	9:25 a. m. 11:15 a. m.	0.02 2.23	0.18 0.15	0.29 0.33	0.32 0.44	0.44 0.56	0.82 0.77	1.32 1.02	1.68 1.17	1.99 1.27	2.07 1.42	2.09 1.52	1.56	1.64		
Davenport, Iowa.	6–7			1.10														*			
Denver, Colo.	18			0.69														*			
Des Moines, Iowa.	22–23			0.68														*			
Detroit, Mich.	6–7			0.26														0.19			
Dodge, Kans.	17–18			0.43														*			
Dubuque, Iowa.	18			0.35														0.34			
Duluth, Minn.	17–18			0.80														*			
Eastport, Me.	22–23			0.81														0.28			
Elkins, W. Va.	20–21			1.11														0.30			
Erie, Pa.	7–8			0.94														*			
Escanaba, Mich.	17–18			0.96														0.41			
Evansville, Ind.	7–8	11:10 p. m.	9:18 a. m.	1.65	11:50 p. m.	12:30 a. m.	0.06	0.15	0.19	0.34	0.57	0.74	0.94	1.06	1.14	1.16	1.18	1.22			
Fort Smith, Ark.	4			0.64														0.26			
Fort Worth, Tex.	9			1.04														0.26			
Galveston, Tex.	2–3	D. N.	12:40 p. m.	1.70	9:55 a. m.	10:55 a. m.	0.12	0.05	0.22	0.72	0.95	1.05	1.08	1.14	1.18	1.22	1.27	1.40			
Do	10	10:20 a. m.	8:30 p. m.	3.98	11:20 a. m. 12:01 p. m. 1:00 p. m.	11:45 a. m. 12:30 p. m. 1:30 p. m.	0.02 0.59 1.49	0.05 0.08 0.25	0.15 0.16 0.56	0.26 0.23 0.95	0.35 0.44 1.08	0.54 0.61 1.23	0.56 0.73 1.30	0.78 1.32	0.79	0.84					
Grand Haven, Mich.	18			0.31									0.31								
Grand Junction, Colo.	30			0.11														0.09			
Green Bay, Wis.	18–19			1.87														*			
Harrisburg, Pa.	22–23			1.96														0.42			
Hatteras, N. C.	7	9:30 p. m.	11:55 p. m.	0.90	11:20 p. m.	11:35 p. m.	0.37	0.12	0.29	0.44	0.50	0.52	.....	.....							
Huron, S. Dak.	18			0.74														0.20			
Indianapolis, Ind.	10			0.49														0.21			
Jacksonville, Fla.	22–23			1.03														0.29			
Jupiter, Fla.	18–19	7:25 p. m.	2:10 p. m.	2.49	12:30 p. m.	1:00 p. m.	1.65	0.08	0.19	0.37	0.57	0.73	0.77	0.81							
Do	24–25	10:55 p. m.	1:05 a. m.	1.04	12:10 a. m.	12:55 a. m.	0.14	0.08	0.18	0.31	0.38	0.45	0.58	0.69	0.83	0.90	0.91				
Do	29	12:52 p. m.	1:35 p. m.	0.89	12:58 p. m.	1:20 p. m.	0.01	0:10	0.40	0.70	0.80	0.85	0.87	.....	.....	.....	.....				
Kalispell, Mont.	28–29			0.31														0.18			
Kansas City, Mo.	19			0.87														0.48			
Key West, Fla.	27	2:45 p. m.	4:55 p. m.	1.04	3:02 p. m.	4:00 p. m.	0.02	0.08	0.12	0.16	0.17	0.25	0.42	0.66	0.74	0.79	0.87	0.95			
Knoxville, Tenn.	7–8			1.72														0.38			
La Crosse, Wis.	16–17			0.46														0.22			
Lewiston, Idaho.	28			0.21														0.21			
Lexington, Ky.	30–31			0.95														*			
Lincoln, Nebr.	26–27			0.19														*			
Little Rock, Ark.	9–10			2.66														0.49			
Los Angeles, Cal.	24–25	8:45 a. m.	8:44 a. m.	3.35	8:45 p. m.	9:10 p. m.	1.21	0.06	0.18	0.25	0.38	0.44	0.45	0.49	0.54	0.55	0.56	0.57			
Louisville, Ky.	7–8			0.94														0.39			
Lynchburg, Va.	22–23			1.91														0.36			
Macon, Ga.	21			0.85									0.80	.....							
Memphis, Tenn.	5			0.88														0.66			
Meridian, Miss.	8			0.60														0.42			
Milwaukee, Wis.	19–20			1.15														0.40			
Montgomery, Ala.	10–11			0.57														0.45			
Nantucket, Mass.	22–23			1.47														0.35			
Nashville, Tenn.	8			1.10														0.41			
New Haven, Conn.	30–31			0.79														0.24			
New Orleans, La.	14	12:45 p. m.	11:00 p. m.	8.33	1:33 p. m. 2:23 p. m. 3:13 p. m. 4:03 p. m. 4:53 p. m.	2:23 p. m. 3:13 p. m. 4:03 p. m. 4:53 p. m. 5:17 p. m.	0.24	0.11 1.68 3.63 5.48 6.45	0.28 1.78 3.79 5.67 6.52	0.37 2.07 3.99 5.96 6.66	0.38 2.14 4.23 6.19 6.89	0.39 2.38 4.31 6.22 6.95	0.46 2.60 4.38 6.35	0.78 2.92 4.52 6.35	1.13 3.21 4.65 6.35	1.38 3.37 4.85 6.40	1.55 3.45 5.16 6.45				
New York, N. Y.	23–24			0.77														0.27			
Norfolk, Va.	21	2:55 p. m.	6:00 p. m.	0.84	3:07 p. m.	3:40 p. m.	0.03	0.08	0.17	0.21	0.26	0.44	0.61	0.64	0.69	0.77	0.78				
Northfield, Vt.	23			1.25														0.13			
North Head, Wash.	9–11			2.04														0.16			
Oklahoma, Okla.	18–19			1.82														0.62			
Omaha, Nebr.	18–19			0.20														0.12			
Palestine, Tex.	7	6:50 p. m.	8:15 p. m.	1.52	7:17 p. m.	7:55 p. m.	0.01	0.08	0.15	0.36	0.68	1.01	1.23	1.34	1.38	1.40	.....				
Parkersburg, W. Va.	7–8	7:59 p. m.	7:46 a. m.	1.63	7:59 p. m.	8:30 p. m.	0.00	0.22	0.43	0.71	0.86	0.93	0.99	1.01	1.04	.....	.....				
Pensacola, Fla.	21			1.08														0.62			
Philadelphia, Pa.	8–9			0.83														0.32			
Pittsburg, Pa.	10			0.70														0.48			
Pocatello, Idaho.																					
Portland, Me.	10–11			1.38														0.34			
Portland, Oreg.	10–11			1.74														0.39			
Pueblo, Colo.	9			0.11														0.09			
Raleigh, N. C.	22–23	D. N.	11:15 a. m.	2.43	2:15 a. m.	3:20 a. m.	0.40	0.08	0.14	0.20	0.27	0.52	0.81	0.87	0.88	0.92	1.08	1.25	1.44		
Richmond, Va.	21	4:07 p. m.	7:10 p. m.	1.56	6:15 p. m.	6:52 p. m.	0.20	0.28	0.60	0.72	0.80	0.91	1.10	1.30	1.34	1.35	.....				
Rochester, N. Y.	23			1.17														*			
Sacramento, Cal.	29–30			0.75														0.39			
St. Louis, Mo.	3–4			1.02														0.25			
St. Paul, Minn.	18			0.58														0.41			
Salt Lake City, Utah.	5–6			0.50														*			

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
San Antonio, Tex	19			0.82														0.54			
San Diego, Cal	4–5			0.58														0.10			
Sandusky, Ohio	20			0.26														0.25			
San Francisco, Cal	28			1.11														0.40			
Savannah, Ga	29	D. N.	9:20 p. m.	3.34	12:15 p. m.	1:05 p. m.	1.81	0.05	0.13	0.21	0.30	0.34	0.37	0.43	0.54	0.67	0.75	0.82	0.93		
Scranton, Pa	22–23			2.07														0.69			
Seattle, Wash	9–11			3.82														0.21			
Shreveport, La	19–20			0.95														0.45			
Spokane, Wash	28			0.34														*			
Springfield, Ill	19–20			0.81														0.19			
Springfield, Mo	19–20			1.16														*			
Tampa, Fla	23	D. N.	7:30 a. m.	1.05	1:45 a. m.	2:05 a. m.	0.05	0.10	0.33	0.55	0.61	0.64	0.67								
Taylor, Tex	19	9:07 a. m.	D. N.	2.50	9:15 a. m.	11:00 a. m.	0.01	0.16	0.43	0.61	0.67	0.68	0.70	0.72	0.82	0.88	0.93	1.14	1.64	1.93	
Toledo, Ohio	7			0.20														0.19			
Topeka, Kan	18–19			0.58														*			
Valentine, Nebr	18–19			0.21														*			
Vicksburg, Miss	8	D. N.	5:15 a. m.	1.79	12:53 a. m.	1:25 a. m.	0.01	0.22	0.41	0.61	0.72	0.84	0.95	1.01	1.03						
Washington, D. C	21–22	5:20 p. m.	11:00 a. m.	1.44	7:30 p. m.	7:45 p. m.	0.10	0.16	0.32	0.36	0.36	0.37	0.40	0.42	0.43						
Wilmington, N. C	29–30			1.98														0.58			
Yankton, S. Dak	16			0.75														*			
Bridgetown, Barbados	10	3:54 p. m.	4:40 p. m.	1.15	3:58 p. m.	4:25 p. m.	T.	0.26	0.64	0.90	1.00	1.09	1.13								
Do	23–24	8:55 p. m.	3:55 a. m.	1.60	11:50 p. m.	12:35 a. m.	0.53	0.15	0.37	0.46	0.57	0.61	0.69	0.75	0.86	0.96	0.97				
Havana, Cuba	16	3:40 p. m.	4:35 p. m.	0.80	3:50 p. m.	4:00 p. m.	0.02	0.39	0.58	0.59	0.61	0.66	0.74	0.77							
Do	21	3:46 p. m.	5:05 p. m.	0.71	4:05 p. m.	4:35 p. m.	T.	0.05	0.21	0.39	0.55	0.63	0.67	0.70							
Do	28	8:35 p. m.	11:10 p. m.	1.17	9:49 p. m.	10:25 p. m.	0.01	0.29	0.42	0.59	0.68	0.84	0.90	1.03	1.06						
San Juan, Porto Rico	21	10:01 a. m.	11:10 a. m.	0.95	10:10 a. m.	11:05 a. m.	T.	0.13	0.23	0.48	0.53	0.59	0.62	0.65	0.66	0.78	0.84	0.95			

*Self-register not working.

TABLE VI.—*Data furnished by the Canadian Meteorological Service, March, 1903.*

Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Temperature. Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Precipitation. Total.	Departure from normal.	Depth of snow.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*
St. Johns, N. F	29.96	30.10	+.22	27.4	— 0.3	34.9	19.9	3.10	—1.66	4.6
Sydney, C. B. I	30.20	30.24	+.36	31.1	+ 4.9	39.0	23.1	4.02	—0.91	8.0
Halifax, N. S	30.12	30.23	+.29	36.0	+ 7.0	43.5	28.5	7.29	+1.83	8.2
Grand Manan, N. B	30.13	30.18	+.25	35.8	+ 6.0	42.0	29.5	9.22	+4.94	3.5
Yarmouth, N. S	30.16	30.23	+.28	37.5	+ 6.7	44.2	30.7	7.29	+2.44	1.3
Charlottetown, P. E. I	30.17	30.21	+.31	30.5	+ 5.1	37.6	23.3	4.71	+1.50	9.3
Chatham, N. B	30.15	30.17	+.27	30.8	+ 7.8	40.0	21.7	3.49	+0.02	12.9
Father Point, Que	30.14	30.16	+.26	28.2	+ 7.9	35.5	20.9	3.74	+1.01	10.6
Quebec, Que	29.84	30.18	+.22	30.2	+ 9.0	36.7	23.8	4.48	+1.22	5.2
Montreal, Que	29.98	30.20	+.20	34.1	+10.3	40.7	27.5	3.50	—0.29	3.1
Bissett, Ont	29.57	30.21	+.20	31.4	+12.4	42.6	20.1	1.11	—0.95	2.3
Ottawa, Ont	29.91	30.25	+.24	34.4	+12.9	42.2	26.7	1.35	—1.37	0.3
Kingston, Ont	29.86	30.18	+.17	37.1	+11.5	44.0	30.3	2.76	+0.12	3.3
Toronto, Ont	29.80	30.19	+.17	39.6	+12.3	46.5	32.7	1.83	—0.81	0.5
White River, Ont	28.82	30.19	+.16	19.9	+ 7.7	33.7	6.1	1.95	+0.57	18.0
Port Stanley, Ont	29.53	30.19	+.16	37.7	+10.5	44.4	31.1	2.81	—0.07	1.2
Saugeen, Ont	29.44	30.17	+.14	37.8	+13.1	45.4	30.1	1.62	—1.03	2.8
Parry Sound, Ont	29.44	30.15	+.13	35.6	+14.5	43.9	27.3	3.21	+0.98	8.3
Port Arthur, Ont	29.40	30.14	+.09	24.0	+ 7.2	33.5	14.5	0.95	—0.02	8.1
Winnipeg, Man	29.27	30.14	+.05	17.8	+ 5.5	27.9	7.7	1.08	+0.05	9.7
Minnedosa, Man	28.23	30.14	+.08	15.8	+ 3.3	28.3	3.4	0.62	—0.03	4.6
Qu'Appelle, Assin	27.74	30.09	+.05	14.0	— 0.9	24.6	3.3	0.42	—0.35	3.6
Medicine Hat, Assin	27.71	30.08	+.08	18.3	— 9.2	30.4	6.2	0.25	—0.51	2.5
Swift Current, Assin										
Calgary, Alberta	26.33	30.03	+.08	14.6	—11.6	26.0	3.3	1.00	+0.28	10.0
Banff, Alberta	25.24	30.03	+.09	16.5	— 3.7	29.4	3.6	4.00	+2.59	38.7
Edmonton, Alberta	27.65	30.04	+.08	16.9	— 7.3	30.0	3.7	0.90	+0.18	9.0
Prince Albert, Sask	28.44	30.07	—.01	9.0	— 3.0	22.1	— 4.0	1.55	+0.78	15.5
Battleford, Sask	28.30	30.15	+.09	8.5	— 4.6	20.7	— 3.6	0.82	+0.36	8.2
Kamloops, B. C	28.71	29.95	+.03	30.3	— 5.8	39.7	20.8	0.62	+0.05	4.6
Victoria, B. C	29.86	29.96	—.01	41.3	— 0.6	47.0	35.5	2.71	—0.41	9.4
Barkerville, B. C	25.55	29.96	+.08	20.2	— 5.9	33.1	7.3	1.95	+0.06	16.0
Hamilton, Bermuda	30.02	30.18	+.10	65.8	+ 3.6	69.6	61.9	4.06	—1.07	0.0
Dawson City, Yukon										

TABLE VII.—*Heights of rivers referred to zeros of gages, March, 1903.*

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water. Height.	Highest water. Date.	Lowest water. Height.	Lowest water. Date.	Mean stage.	Monthly range.
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn.[1]	1,954	14	8.3	26–28	5.6	14	7.3	2.7
Red Wing, Minn.[1]	1,914	14	8.3	25	3.7	14	6.6	4.6
Reeds Landing, Minn.	1,884	12	7.7	25	0.1	1–6	3.6	7.6
La Crosse, Wis.[2]	1,819	12	9.5	27	5.1	14	7.8	4.4
Prairie du Chien, Wis.[10]	1,759	18	12.0	30, 31	6.7	18	.....	5.3
Dubuque, Iowa.[3]	1,699	15	12.6	31	4.8	12	7.9	7.8
Leclaire, Iowa[4]	1,609	10	7.2	31	3.3	13	5.0	3.9
Davenport, Iowa[5]	1,593	15	9.1	31	5.5	8	7.2	3.6
Muscatine, Iowa	1,562	16	10.7	31	5.0	1	8.2	5.7
Galland, Iowa	1,472	8	5.5	8, 31	2.4	4	4.5	3.1
Keokuk, Iowa	1,463	15	9.8	31	4.0	1	8.3	5.8
Hannibal, Mo.	1,402	13	11.5	9	7.0	6	10.2	4.5
Grafton, Ill.	1,306	23	17.5	11	10.2	1	15.2	7.3
St. Louis, Mo	1,264	30	25.8	11	15.6	1	21.9	10.2
Chester, Ill	1,189	30	22.3	12	12.0	1	18.9	10.3
New Madrid, Mo.	1,003	34	39.5	16–18	33.4	31	36.8	6.1
Memphis, Tenn	843	33	40.1	29	34.0	1	37.0	6.1
Helena, Ark	767	42	51.0	25–27	43.8	1	47.5	7.2
Arkansas City, Ark	635	42	53.0	27, 28	46.1	1	50.2	6.9
Greenville, Miss	595	42	49.1	27	40.2	1	45.1	8.9
Vicksburg, Miss	474	45	51.8	27, 28	44.3	1	48.6	7.5
New Orleans, La	108	16	20.3	27, 29, 30	16.3	1	18.9	4.0
Yellowstone River.								
Glendive, Mont.[6]	98	17	5.0	30, 31	4.1	17	4.5	0.9
James River.								
Lamoure, N. Dak.[7]	.....	25	.....	.....	.....	.....	.....	.....
Huron, S. Dak.[8]	210	9	5.0	12–14	1.8	8	3.5	3.2
Missouri River.								
Townsend, Mont.[6]	2,504	10	6.7	16–23	4.3	26, 27	5.7	2.4
Fort Benton, Mont.[6]	2,285	12	6.0	17	1.6	22, 24, 25	2.6	4.4
Bismarck, N. Dak.	1,309	14	4.3	30, 31	3.2	2–4	3.9	1.1
Pierre, S. Dak.[8]	1,114	14	.....	.....	.....	.....	.....	.....
Sioux City, Iowa[3]	784	19	10.2	12	6.7	30, 31	7.7	3.5
Omaha, Nebr.[9]	669	18	10.8	13	7.6	2, 11	8.4	3.2
Plattsmouth, Nebr.	.....	.....	8.5	10	4.5	31	5.9	4.0
St. Joseph, Mo.	481	10	7.4	14	2.8	1	5.0	4.6
Kansas City, Mo.	388	21	16.7	15	8.6	1	12.3	8.1
Glasgow, Mo.	231	.....	10.6	16	5.1	1	7.9	5.5
Boonville, Mo.	199	20	14.4	16	10.1	1	12.5	4.3
Hermann, Mo.	103	24	18.0	8	10.9	31	14.5	7.1
Illinois River.								
Peoria, Ill.	135	14	19.3	12, 13	15.5	1	17.6	3.8
Youghiogheny River.								
Confluence, Pa.	59	10	6.6	24	3.4	20, 21	4.4	3.2
West Newton, Pa.	15	23	15.4	1, 11	1.9	20	4.5	13.5

TABLE VII.—*Heights of rivers referred to zeros of gages*—Continued.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Allegheny River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Warren, Pa.	177	14	9.8	1,11	3.0	21,31	5.9	6.8
Oil City, Pa	123	13	12.9	1	3.2	31	6.7	9.7
Parker, Pa.	73	20	15.0	1	3.5	31	7.5	11.5
Freeport, Pa	29	20	23.0	1	7.0	21,30	12.1	16.0
Clarion River.								
Clarion, Pa.	32	10	11.3	1	2.9	30,31	5.1	8.4
Monongahela River.								
Weston, W. Va.	161	18	12.0	23	3.0	20	4.4	9.0
Fairmont, W. Va.	119	25	19.5	1	2.5	20	5.8	17.0
Greensboro, Pa.	81	18	24.7	1	8.0	20	11.0	16.7
Lock No. 4, Pa.	40	28	32.5	1	7.7	21	13.1	24.8
Conemaugh River.								
Johnstown, Pa.	64	7	7.8	1	2.8	20-22	3.8	5.0
Red Bank Creek.								
Brookville, Pa.	35	8	3.8	1	0.5	30	1.6	3.3
Beaver River.								
Ellwood Junction, Pa.	10	14	11.0	1	3.4	31	5.0	7.6
Great Kanawha, River.								
Charleston, W. Va.	58	30	33.0	24	5.7	20	10.7	27.3
Little Kanawha River.								
Glenville, W. Va	103	20	15.6	23	−1.0	20	3.2	16.6
New River.								
Radford, Va	155	14	15.0	23	1.0	6,7,20,21	2.3	14.0
Hinton, W. Va.	95	14	14.9	24	2.9	21	5.1	12.0
Cheat River.								
Rowlesburg, W. Va.	36	14	8.7	1	1.6	21	3.5	7.1
Ohio River.								
Pittsburg, Pa.	966	22	28.9	1	5.4	21	12.0	23.5
Davis Island Dam, Pa.	960	25	26.5	1	7.5	21	12.6	19.0
Beaver Dam, Pa	925	27	38.1	2	10.0	21	18.4	28.1
Wheeling, W. Va.	875	36	40.2	2	10.0	22	19.6	30.2
Parkersburg, W. Va.	785	36	39.9	3	10.6	21	22.9	29.3
Point Pleasant, W. Va.	705	39	45.0	4	15.5	21	30.5	29.5
Huntington, W. Va.	660	50	48.3	4	20.2	21,22	35.5	28.1
Catlettsburg, Ky.	651	50	49.7	4	20.4	22	36.5	29.3
Portsmouth, Ohio	612	50	51.3	4	22.5	22	38.6	28.8
Cincinnati, Ohio.	499	50	53.2	5	26.2	23	42.5	27.0
Madison, Ind	413	46	45.0	6	23.5	24	37.0	21.5
Louisville, Ky.	367	28	28.5	9	9.8	24,25	19.6	18.7
Evansville, Ind.	184	35	42.4	11	26.7	27	36.9	15.7
Paducah, Ky.	47	40	47.6	15,16	32.4	31	41.7	15.2
Cairo, Ill.	1,073	45	50.6	15-17	40.7	31	46.6	9.9
Muskingum River.								
Zanesville, Ohio	70	20	23.8	1	8.6	30	15.7	15.2
Scioto River.								
Columbus, Ohio.	110	17	15.8	1	3.5	30,31	6.6	12.3
Miami River.								
Dayton, Ohio	77	18	11.8	1	2.4	28-31	4.5	9.4
Wabash River.								
Mount Carmel, Ill.	50	15	22.3	12	6.6	31	17.3	15.7
Licking River.								
Falmouth, Ky.	30	25	18.5	1	3.0	28	7.4	15.5
Kentucky River.								
High Bridge, Ky.	117	17	23.4	3	12.0	20,29,30	15.1	11.4
Frankfort, Ky.	65	31	21.9	3	8.0	30	11.3	13.9
Hiwassee River.								
Charleston, Tenn.	18	22	23.5	1	4.5	20	9.2	19.0
Holston River.								
Rogersville, Tenn.	103	14	14.3	24	2.9	20,21	4.6	11.4
French Broad River.								
Asheville, N. C.[11]		6						
Leadvale, Tenn.	70	15	11.0	23	1.2	20	3.9	9.8
Clinch River.								
Speers Ferry, Va.	156	20	16.9	23	1.0	20	3.6	15.9
Clinton, Tenn.	52	25	22.5	25	7.5	20,21	13.1	15.0
Tennessee River.								
Knoxville, Tenn.	635	29	24.6	24	3.9	20	8.8	20.7
Kingston, Tenn.	556	25	20.2	25	4.0	22	10.0	16.2
Chattanooga, Tenn.	452	33	31.1	2	9.0	20-22	17.8	22.1
Bridgeport, Ala.	402	24	23.4	3	7.0	21	14.3	16.4
Florence, Ala.	255	16	18.7	6,7	7.7	23,24	14.0	11.0
Riverton, Ala.	225	25	31.0	8	10.8	24	22.5	20.2
Johnsonville, Tenn.	95	24	33.7	11	14.5	26	25.6	19.2
Cumberland River.								
Burnside, Ky.	516	50	55.1	1	6.2	30	16.6	48.9
Carthage, Tenn.	305	40	36.3	3	9.5	30	22.0	26.8
Nashville, Tenn.	189	40	40.7	9	13.8	31	27.7	26.9
Clarksville, Tenn.	126	42	49.6	11	17.0	31	34.3	32.6
Arkansas River.								
Wichita, Kans.	832	10	2.3	15	1.4	1,2	1.9	0.9
Webbers Falls, Ind. T.	465	23	18.8	11	6.4	31	11.2	12.4
Fort Smith, Ark.	403	22	21.6	11	7.2	31	13.4	14.4
Dardanelle, Ark.	256	21	20.9	12	8.9	31	14.8	12.0
Little Rock, Ark.	176	23	23.3	13	11.5	31	17.8	11.8
White River.								
Newport, Ark.	150	26	28.7	12,13	18.5	31	23.3	10.2
Yazoo River.								
Yazoo City, Miss.	80	25	28.6	31	24.1	1	26.4	4.5
Red River.								
Arthur City, Tex.	638	27	21.0	2	9.4	31	13.8	11.6
Fulton, Ark.	515	28	31.2	14	22.0	31	28.0	9.2
Shreveport, La.	327	29	33.1	22,23	28.8	1	31.4	4.3
Alexandria, La.	118	33	36.2	27-29	29.6	1	34.4	6.6
Ouachita River.								
Camden, Ark.	304	39	39.4	14	17.3	31	27.1	22.1
Monroe, La.	122	40	44.5	26-29	37.6	1	41.8	6.9
Atchafalaya River.								
Melville, La.	100	31	38.5	29-31	34.4	1	36.9	4.1

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Penobscot River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Mattawamkeag, Me.[5]	87	.....	18.7	13	15.3	19,20	16.6	3.4
Montague, Me.[5]	60	.....	17.0	12	10.7	19	12.5	6.3
Kennebec River.								
Solon, Me	86	.....	4.0	24	1.0	31	2.5	3.0
Winslow, Me	46	.....	8.5	12	3.1	30,31	6.0	5.4
Merrimac River.								
Franklin Junction, N. H.	110	.....	15.0	12	6.2	6-8	9.9	8.8
Concord, N. H.[5]	94	.....	8.5	13	4.4	8	6.4	4.1
Manchester, N. H.	68	.....	6.1	13	2.6	30,31	4.1	3.5
Connecticut River.								
Wells River, Vt.[5]	255	.....	32.8	24	24.3	8	28.9	8.5
White River Junction, Vt.	209	.....	21.8	24	8.5	7,8	14.7	13.3
Bellows Falls, Vt.	170	12	11.8	24	4.0	7	7.2	7.8
Holyoke, Mass.	84	9	9.8	12,25	3.8	7	6.8	6.0
Hartford, Conn.	50	13	23.3	26	9.9	8	16.9	13.4
Housatonic River.								
Gaylordsville, Conn.	50	15	9.3	1	5.6	21	7.0	3.7
Susquehanna River.								
Binghamton, N. Y.	306	16	13.7	1	5.4	21	8.6	8.3
Towanda, Pa.	262	16	15.5	24	4.3	21	8.9	11.1
Wilkesbarre, Pa.	183	17	22.4	25	8.3	22	13.9	14.1
Harrisburg, Pa	69	17	17.1	2	4.9	21	9.0	12.2
West Branch Susquehanna.								
Lockhaven, Pa	65	12	8.5	1	1.4	21,22	3.3	7.1
Williamsport, Pa.	39	20	17.7	1	4.4	21	8.4	13.3
Juniata River.								
Huntingdon, Pa.	90	24	10.3	23	4.0	20,21	5.3	6.3
Shenandoah River.								
Riverton, Va	58	22	8.0	1,23,31	1.5	29,30	3.3	6.5
Potomac River.								
Cumberland, Md.	290	8	8.0	1	3.3	20	4.8	4.7
Harpers Ferry, W. Va.	172	18	14.0	1	3.0	18-21	6.6	11.0
James River.								
Lynchburg, Va.	260	18	12.7	24	2.0	21	4.3	10.7
Richmond, Va.	111	12	14.0	25	0.8	21	4.2	13.2
Dan River.								
Danville, Va	55	8	8.6	23	0.5	20	2.1	8.1
Roanoke River.								
Clarksville, Va	196	12	16.8	25	4.7	21	7.6	12.1
Weldon, N. C.	129	30	42.7	26	11.9	21	21.4	30.8
Cape Fear River.								
Fayetteville, N. C.	112	38	50.5	25	7.2	21	20.3	43.3
Edisto River.								
Edisto, S. C.	75	6	4.9	31	3.6	17	4.2	1.3
Pedee River.								
Cheraw, S. C.	149	27	33.8	24	5.8	21	16.8	28.0
Black River.								
Kingstree, S. C.	52	12	10.5	5	8.8	23,24	9.5	1.7
Lynch Creek.								
Effingham, S. C.	35	12	10.6	9	7.1	13	9.0	3.5
Santee River.								
St. Stephens, S. C.	97	12	15.6	31	8.6	26,27	9.6	7.0
Congaree River.								
Columbia, S. C.	37	15	23.9	24	2.4	20,21	7.8	21.5
Wateree River.								
Camden, S. C.	45	24	30.4	25	8.5	21	18.5	21.9
Waccamaw River.								
Conway, S. C.	40	7	6.7	1	4.6	22	5.4	2.1
Savannah River.								
Calhoun Falls, S. C.	347	15	14.5	24	3.6	8,11	5.6	10.9
Augusta, Ga.	268	32	30.0	25	11.6	21	17.7	18.4
Broad River.								
Carlton, Ga.	30	11	21.0	24	3.2	20	5.7	17.8
Flint River.								
Albany, Ga.	80	20	13.6	31	7.0	2	9.6	6.6
Chattahoochee River.								
Oakdale, Ga.	305	18	23.4	24	4.6	19	10.3	18.8
Westpoint, Ga.	239	20	15.5	26	5.0	20	8.9	10.5
Eufaula, Ala	90	40	30.0	25	7.8	22	11.4	22.2
Ocmulgee River.								
Hollingsworth Ferry, Ga.	172	8	13.3	31	8.6	24-27	9.7	4.7
Macon, Ga.	125	18	19.0	25	6.4	21	10.7	12.6
Oconee River.								
Dublin, Ga	79	20	17.6	30	5.9	22	10.5	11.7
Coosa River.								
Rome, Ga.	271	30	28.6	1	5.3	20	14.2	23.3
Gadsden, Ga.	144	18	22.2	6	7.3	19,20	15.5	14.9
Alabama River.								
Montgomery, Ala.	265	35	39.7	3	11.9	22	25.1	27.8
Selma, Ala	212	35	42.8	5	16.0	22,23	29.4	26.8
Tombigbee River.								
Columbus, Miss	303	33	20.0	16	3.4	30	12.8	16.6
Demopolis, Ala.	155	35	54.1	1	24.2	31	46.6	29.9
Black Warrior River.								
Tuscaloosa, Ala.	90	43	54.3	1	11.6	29	29.1	42.7
Brazos River.								
Kopperl, Tex	369	21	7.0	1	0.6	30,31	2.8	6.4
Waco, Tex.	301	24	14.5	20	5.0	19	7.9	9.5
Booth, Tex	76	39	38.7	7	12.5	31	24.4	26.2
Red River of the North.								
Moorhead, Minn.[12]	418	26	.....	.....	.....	.....	.....	.....
Columbia River.								
Umatilla, Oreg.	270	25	8.1	31	−0.5	1	1.6	8.6
The Dalles, Oreg.	166	40	11.8	31	1.5	13	3.8	10.3
Willamette River.								
Albany, Oreg	118	20	10.0	13	4.5	5-9, 23, 24	5.7	5.5
Portland, Oreg.	12	15	7.8	31	2.4	9	4.8	5.4
Sacramento River.								
Red Bluff, Cal.	265	23	19.8	29	5.2	3	9.2	14.6
Sacramento, Cal.	64	29	25.1	31	18.3	3	20.1	6.8

(1) Frozen for 13 days. (2) Frozen for 12 days. (3) Frozen for 11 days. (4) Frozen for 8 days. (5) Frozen for 7 days. (6) 16 days only. (7) No observations.
(8) Frozen for 30 days. (9) Frozen for 1 day. (10) Frozen for 17 days. (11) Data incomplete. (12) Frozen for 26 days.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physico-Geographic Institute.

TABLE 1.—*Hourly observations at the Observatory, San José de Costa Rica, during March, 1903.*

Hours.	Pressure.		Temperature.		Relative humidity.		Rainfall.		
	Observed, 1903.	Normal, 1889-1900.	Observed, 1903.	Normal, 1889-1900.	Observed, 1903.	Normal, 1889-1900.	Observed, 1903.	Normal, 1889-1900.	Duration, 1903.
	Inches.	*Inches.*	° *F.*	° *F.*	%	%	*Ins.*	*Ins.*	*Hrs.*
1 a. m	26.16	26.15	61.9	61.3	79	84	.....	T.	.....
2 a. m	26.15	26.13	60.8	61.8	81	84	.....	0.01	.....
3 a. m	26.13	26.11	60.3	61.5	79	85	.....	.....	.....
4 a. m	26.12	26.11	60.2	61.2	79	85	.....	.....	.....
5 a. m	26.12	26.11	59.9	60.9	78	84	.....	.....	.....
6 a. m	26.13	26.12	59.7	60.7	77	84	.....	.....	.....
7 a. m	26.15	26.14	59.6	61.2	78	83	.....	.....	.....
8 a. m	26.16	26.16	63.4	64.0	65	77	.....	.....	.....
9 a. m	26.17	26.17	68.2	68.0	56	68	.....	.....	.....
10 a. m	26.18	26.17	73.1	72.7	54	62	.....	.....	.....
11 a. m	26.17	26.16	76.2	75.9	46	55	.....	.....	.....
Noon	26.16	26.15	78.2	77.7	43	53	.....	.....	.....
1 p. m	26.14	26.13	79.2	79.5	49	51	.....	T.	.....
2 p. m	26.12	26.11	78.7	79.4	47	52	0.02	0.01	0.33
3 p. m	26.10	26.09	77.2	77.5	51	54	0.01	0.01	0.33
4 p. m	26.09	26.08	75.0	75.4	57	59	.....	0.09	.....
5 p. m	26.10	26.08	71.8	70.2	60	64	.....	0.07	.....
6 p. m	26.10	26.09	69.1	68.3	67	71	0.04	0.05	0.67
7 p. m	26.12	26.11	68.5	66.7	75	77	0.04	0.12	1.00
8 p. m	26.14	26.13	65.4	65.4	76	80	.....	0.03	.....
9 p. m	26.16	26.15	64.4	64.7	77	81	.....	0.02	.....
10 p. m	26.17	26.16	63.5	64.2	78	83	.....	0.04	.....
11 p. m	26.17	26.16	62.8	63.1	79	83	.....	0.01	.....
Midnight	26.17	26.16	62.6	62.8	79	83	.....	0.02	.....
Mean	26.14	26.13	67.4	67.6	68	73	.....	.....	.....
Minimum	25.99	25.98	51.1	49.8	23	.....	.....	.....	.....
Maximum	26.22	26.27	86.0	90.7	96	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	0.11	0.48	2.33

REMARKS.—At San José the barometer is 1,169 meters above sea level. Readings are corrected for gravity, temperature, and instrumental error. The hourly readings for pressure, and wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The thermometers are 1.5 meters above ground and are corrected for instrumental errors. The total hourly rainfall is as given by Hottinger's self-register, checked once a day. Under maximum, the greatest hourly rainfall for the month is given. The standard rain gage is 1.5 meters above ground. Since January 1, 1902, observations at San José have been made on seventy-fifth meridian time, which is 0 hours, 36 minutes, 13.3 seconds *in advance* of San José local time. The normals for pressure, temperature, and relative humidity have been adjusted to this time; the normal for rainfall in Table 1 and the sunshine observations and normal in Table 2 refer to local time. At Port Limon the hours of direct observation are 8 a. m., 2 and 8 p. m., San José local time; the barometer is 3.4 meters above sea level. The means for temperature and relative humidity in Table 4 are obtained from two-hourly readings given by a Richard self-registering thermometer.

TABLE 2.—*San José, March, 1903.*

Time.	Sunshine.		Cloudiness.		Temperature of the soil at depth of—				
	Observed, 1903.	Normal, 1889-1900.	Observed, 1903.	Normal, 1889-1900.	6 inches.	12 inches.	24 inches.	48 inches.	120 inches.
	Hours.	*Hours.*	%	%	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*
7 a. m	16.31	12.94	30	35	72.1	73.1	73.9	71.9	71.2
8 a. m	29.01	23.80	.....	.....	.....	.....	.....	.....	.....
9 a. m	27.29	23.77	.....	.....	.....	.....	.....	.....	.....
10 a. m	25.83	22.72	48	42	72.3	73.0	74.1	72.3	.....
11 a. m	24.25	22.25	.....	.....	.....	.....	.....	.....	.....
Noon	24.46	21.78	.....	.....	.....	.....	.....	.....	.....
1 p. m	24.28	22.07	50	49	74.0	73.6	74.1	72.2	.....
2 p. m	24.16	22.64	.....	.....	.....	.....	.....	.....	.....
3 p. m	22.56	20.74	.....	.....	.....	.....	.....	.....	.....
4 p. m	19.72	17.64	59	60	74.9	74.1	74.0	72.1	.....
5 p. m	17.06	12.90	.....	.....	.....	.....	.....	.....	.....
6 p. m	5.18	4.73	.....	.....	.....	.....	.....	.....	.....
7 p. m	.....	.....	59	58	74.0	74.1	74.0	71.9	.....
8 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
9 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
10 p. m	.....	.....	34	44	73.8	73.9	74.0	71.9	.....
11 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
Midnight	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mean	.....	.....	45	48	73.6	73.7	74.0	72.0	71.2
Total	260.02	227.98	.....	.....	.....	.....	.....	.....	.....

TABLE 3.—*Rainfall at stations in Costa Rica, March, 1903.*

Stations.	Height above sea level.	Observed, 1903.		Averages.		
		Amount.	Number of days.	Number of years.	Amount.	Number of days.
	Feet.	*Inches.*			*Inches.*	
Sipurio (Talamanca)	197	5.79	11	2	4.80	11
Boca Banano	10	7.40	14	7	7.64	17
Port Limon	10	3.07	9	6	8.90	17
Swamp Mouth	10	6.10	10	3	8.70	13
Zent	66	15.00	15	1	11.81	13
Siquirres	197	10.35	6	4	7.20	10
Dos Novillos	400	11.38	12	.....	.....	.....
Guapiles	984	10.24	10	2	4.88	12
Cariblanco (Sarapiqui)	2,740	8.50	12	5	5.94	14
San Carlos	328	13.74	8	4	2.68	11
Las Lomas	873	8.66	12	2	4.49	11
Peralta	1,089	15.32	10	4	5.59	13
Turrialba	2,034	11.81	8	6	2.80	11
Juan Viñas	3,412	1.81	5	5	2.56	5
Santiago	3,609	3.03	7	1	3.90	4
Paraiso	4,383	0.55	5	1	1.30	4
Cachi	3,346	0.20	8	1	2.44	8
Las Concavas	4,386	1.50	12	1	1.54	9
Tres Rios	4,265	1.18	3	14	0.28	2
San Isidro Arenilla	.....	.....	.....	.....	.....	.....
San Francisco Guadalupe	3,894	0.04	1	7	0.75	12
San Jose	3,806	0.12	2	14	0.63	2
La Verbena	3,740	1.81	3	7	0.35	2
Nuestro Amo	2,595	0.08	1	7	0.87	2
Alajuela	3,117	0.00	0	2	1.38	4
San Isidro Alajuela	4,416	0.00	0	1	4.88	9

TABLE 4.—*Observations taken at Port Limon and Zent, March, 1903.*

Stations.	Pressure.			Temperature.			Relative humidity.
	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.	
	Inches.	*Inches.*	*Inches.*	° *F.*	° *F.*	° *F.*	%
Port Limon	29.74	29.98	29.85	62.6	86.0	76.0	85
Zent	.....	.....	.....	57.2	95.0	76.6	83

Stations.	Cloudiness.	Sunshine.	Rainfall.		Temperature of soil at depth of—		
			Amount.	Number of days.	6 inches.	12 inches.	24 inches.
	%	*Hours.*	*Inches.*		° *F.*	° *F.*	° *F.*
Port Limon	.....	.....	3.07	9	.....	.....	.....
Zent	70	183.01	15.00	15	79.6	79.1	79.2

MEXICAN CLIMATOLOGICAL DATA.

By Señor MANUEL E. PASTRANA, Director of the Central Meteorologic-Magnetic Observatory.

March, 1903.

Stations.	Altitude.	Mean barometer.*	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	*Inches.*	° *F.*	° *F.*	° *F.*	%	*Ins.*		
Chihuahua	4,684	25.26	80.6	36.3	61.3	36	T.	ne.	.....
Guadalajara (Obs. del. Est.)	5,186	24.89	82.4	50.0	64.9	50	0.35	se.	.....
Guanajuato	6,640	.....	.....	.....	.....	.....	.....	.....	.....
Leon (Guanajuato)	5,906	24.22	86.2	41.7	63.9	49	0.49	ne.	.....
Mazatlan	25	29.88	81.0	63.9	72.7	72	.....	nw.	.....
Merida	50	.....	.....	.....	.....	.....	.....	.....	.....
Mexico (Obs. Cent.)	7,472	23.00	79.3	40.6	61.2	44	0.02	.....	.....
Mexico (E. N. Agric.)	7,442	.....	.....	.....	.....	.....	.....	.....	.....
Monterey (Seminario)	1,626	.....	.....	.....	.....	.....	.....	.....	.....
Morelia (Seminario)	6,401	23.89	76.6	41.7	59.5	61	.....	s.	s. sw.
Pachuca	7,959	22.52	74.5	50.0	62.6	66	0.69	ne.	.....
Puebla (Col. Cath.)	7,108	.....	.....	.....	.....	.....	.....	.....	.....
Puebla (Col. d Est.)	7,118	23.29	82.2	38.1	59.9	51	0.52	ene.	.....
Queretario	6,070	.....	.....	.....	.....	.....	.....	.....	.....
Toluca	8,812	.....	.....	.....	.....	.....	.....	.....	.....
Zacatecas	8,015	22.44	81.9	32.4	56.5	43	0.04	w.	.....
Zapotlan	5,078	25.02	86.2	47.8	66.4	49	.....	sse.	.....

*The monthly barometric means are reduced to the international standard of gravity.

Chart I. Tracks of Centers of High Areas. March, 1903.
Barkerville

Chart I. Tracks of Centers of High Areas. March, 1903.

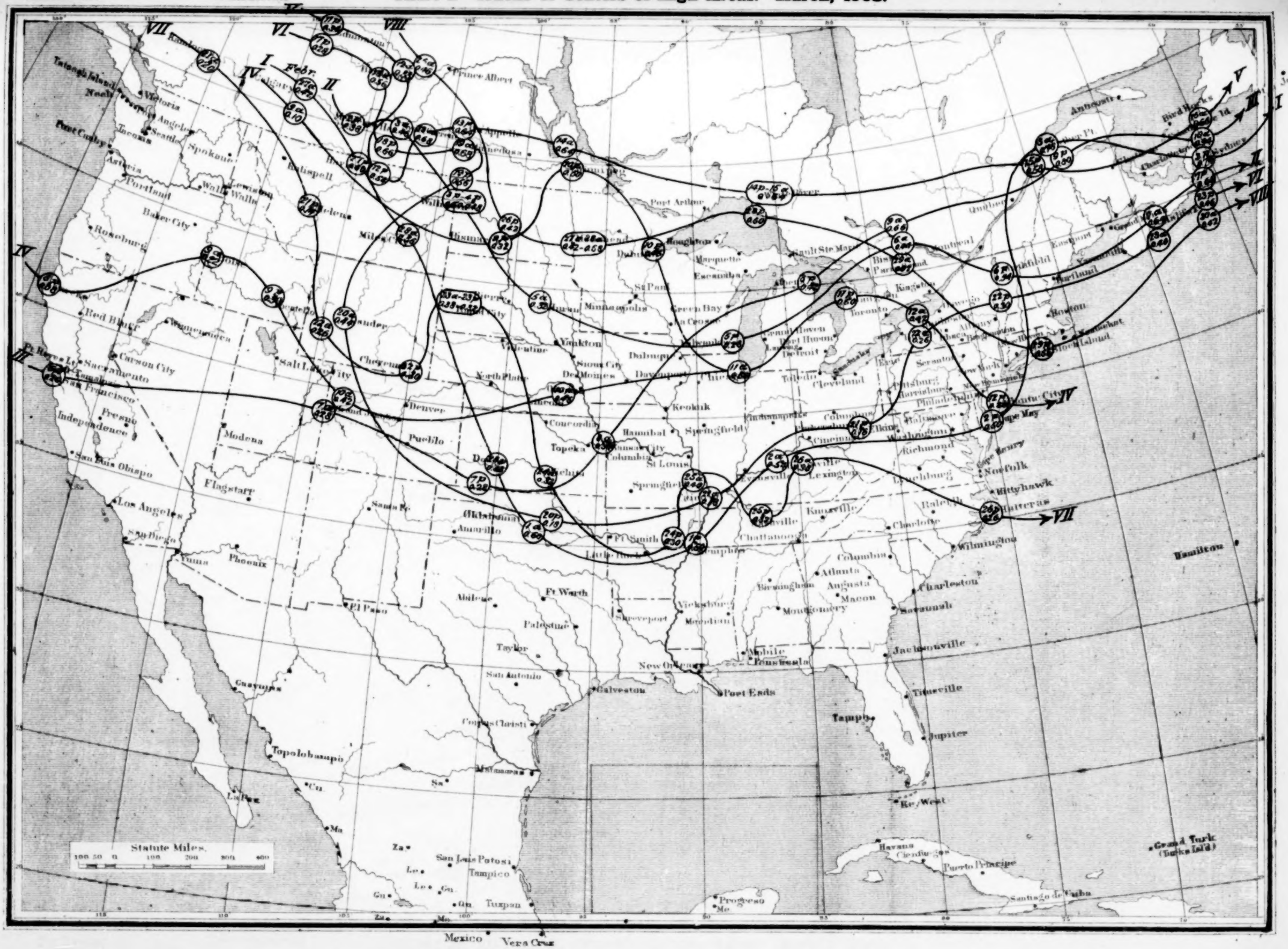


Chart II. Tracks of Centers of Low Areas. March, 1903.

Chart III. Total Precipitation. March, 1903.

Chart III. Total Precipitation. March, 1903.

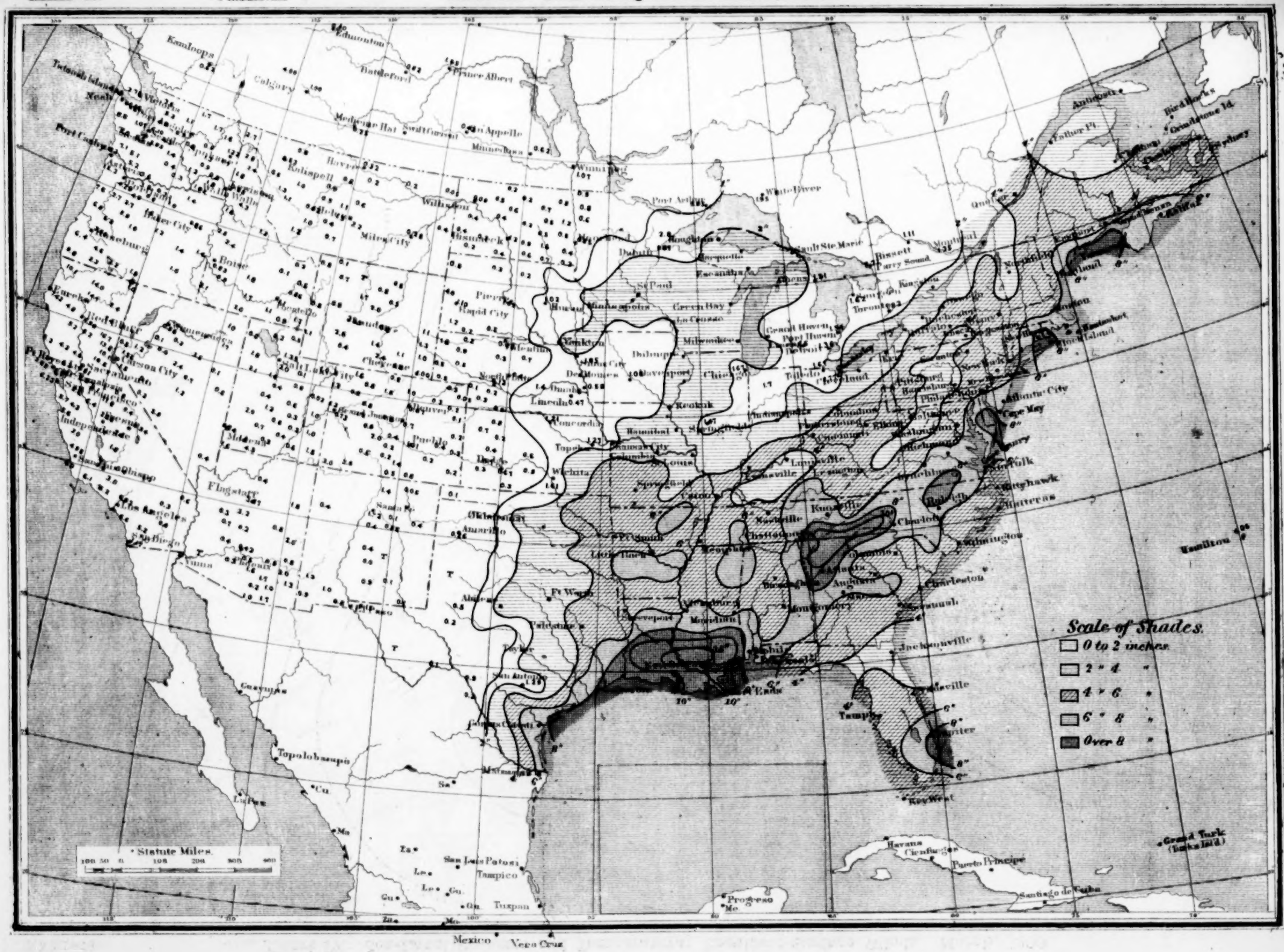


Chart IV. Sea-Level Pressure and Temperature; Resultant Surface Winds. March, 1903.

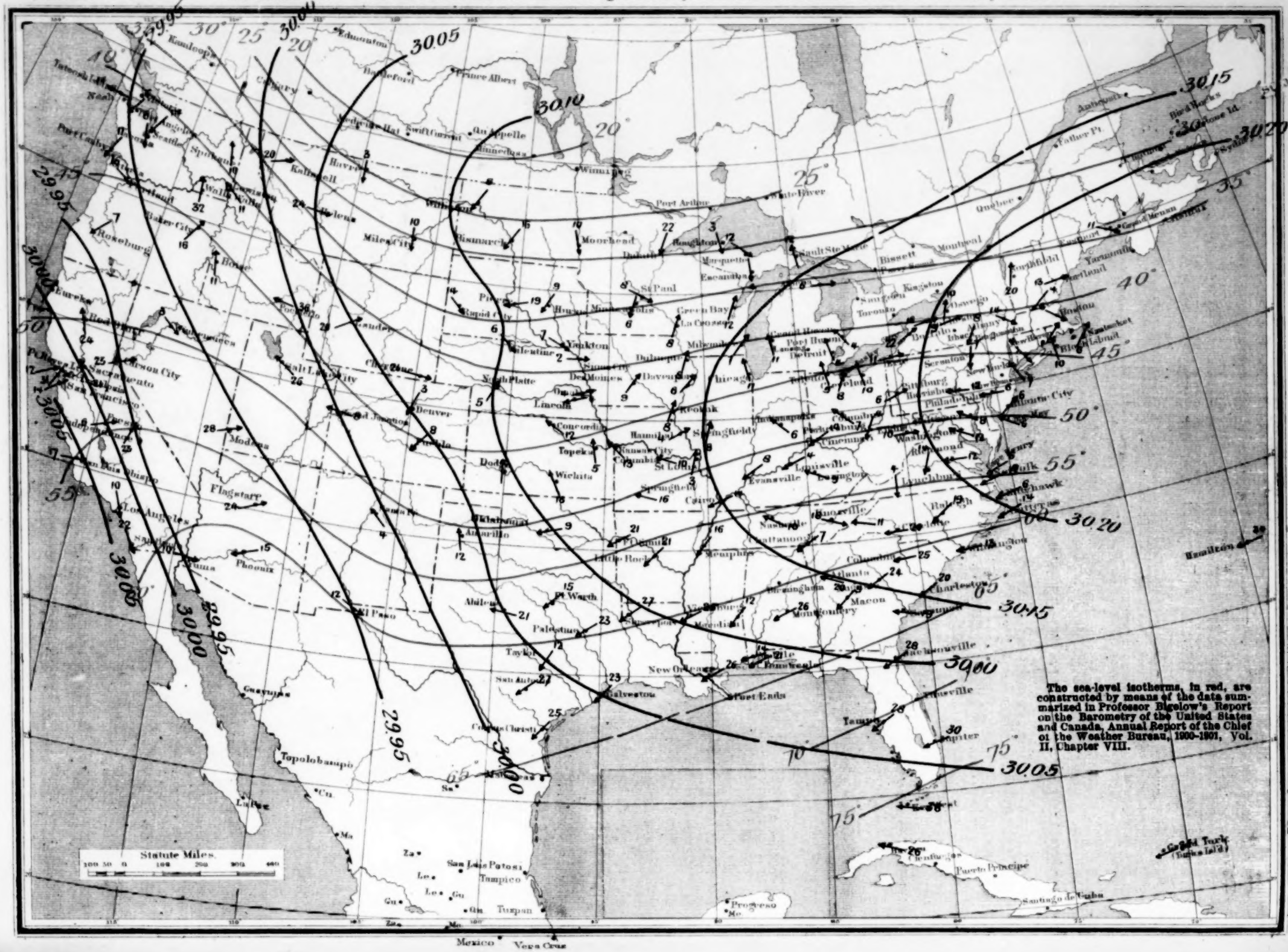

Statute Miles.
100 50 0 100 200 300 400
The sea-level isotherms, in red, are constructed by means of the data summarized in Professor Bigelow's Report on the Barometry of the United States and Canada, Annual Report of the Chief of the Weather Bureau, 1900-1901, Vol. II, Chapter VIII.

Chart V. Hydrographs for Seven Principal Rivers of the United States. March, 1903.

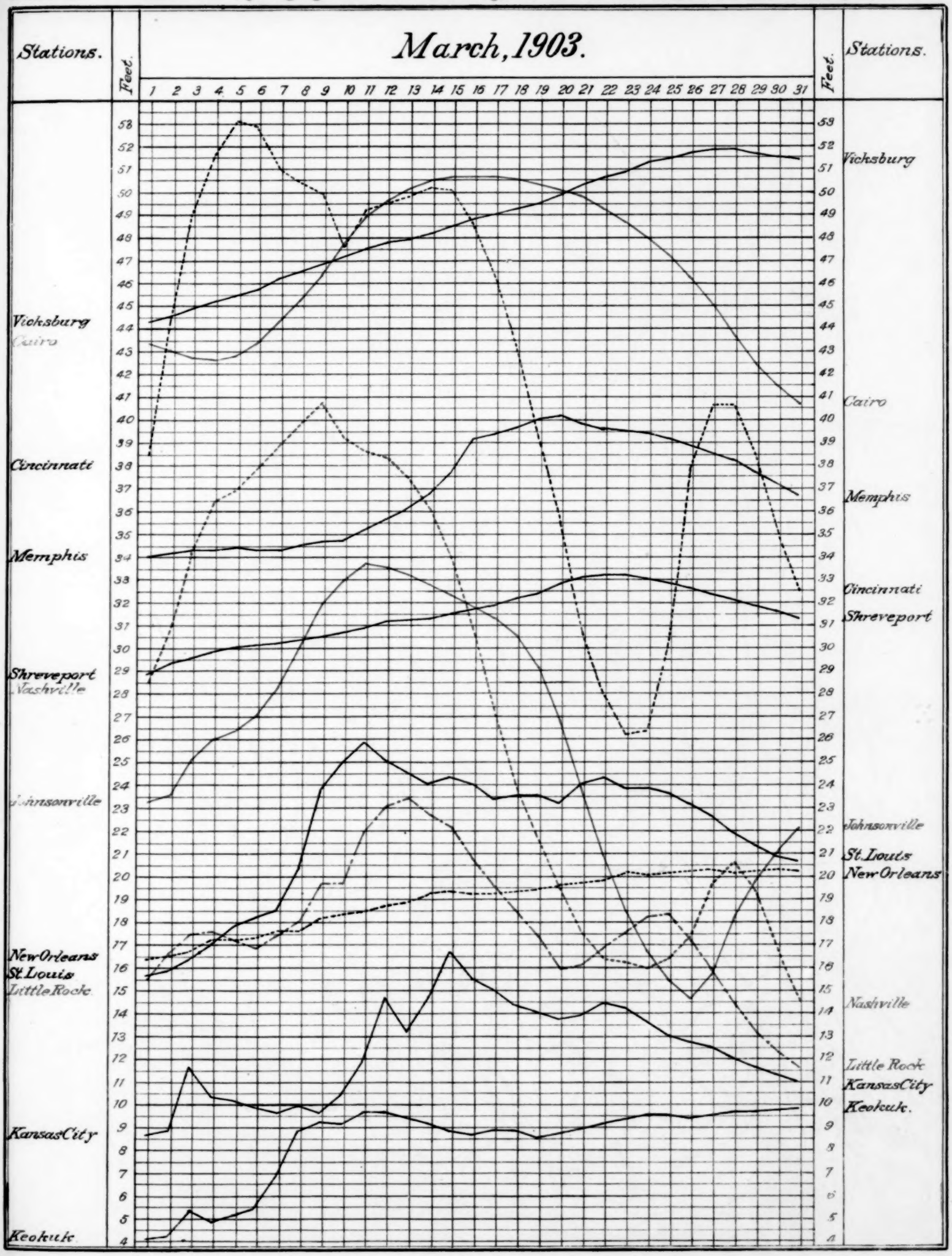


Chart VI. Surface Temperatures; Maximum, Minimum, and Mean. March, 1903.

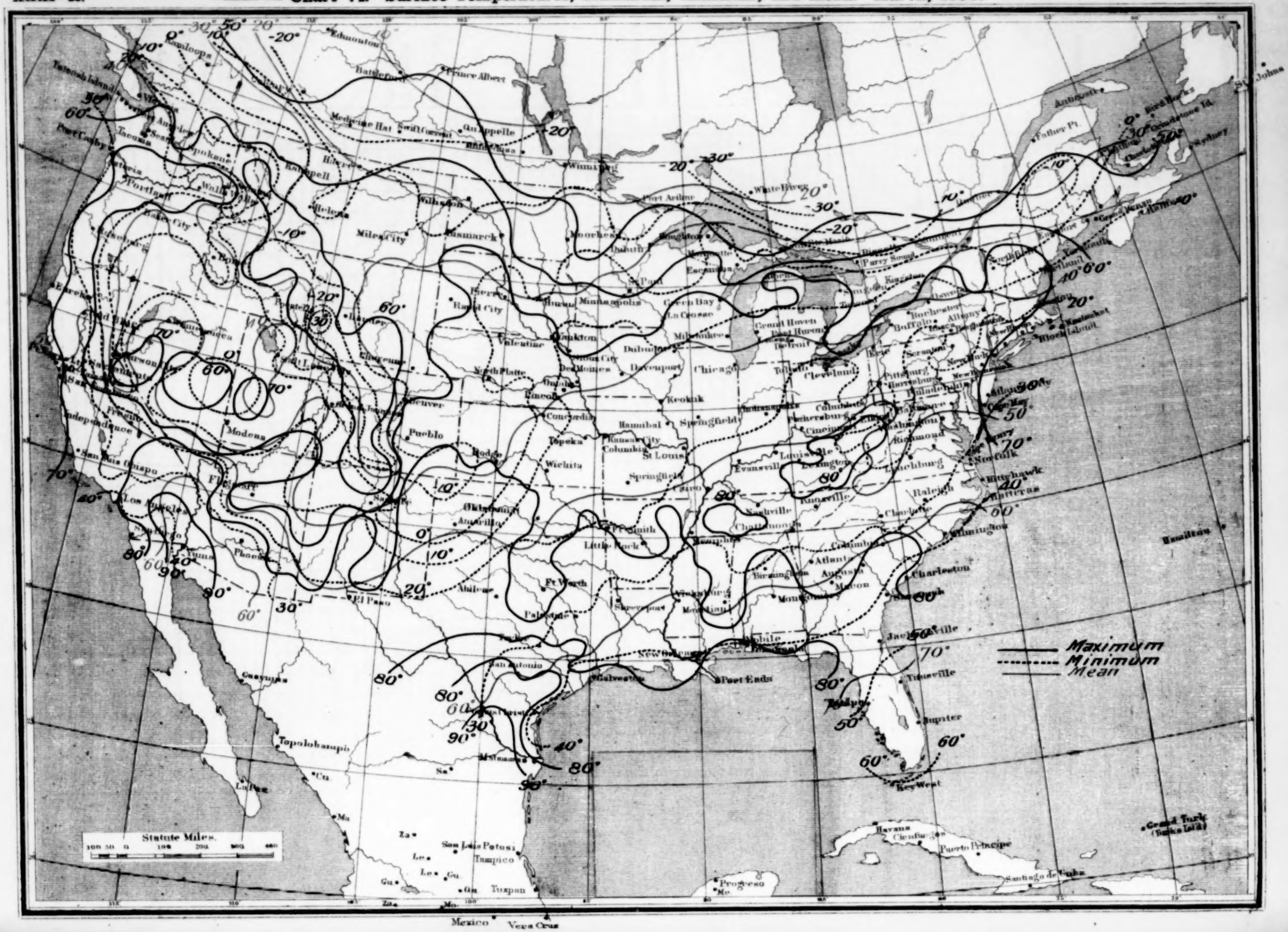
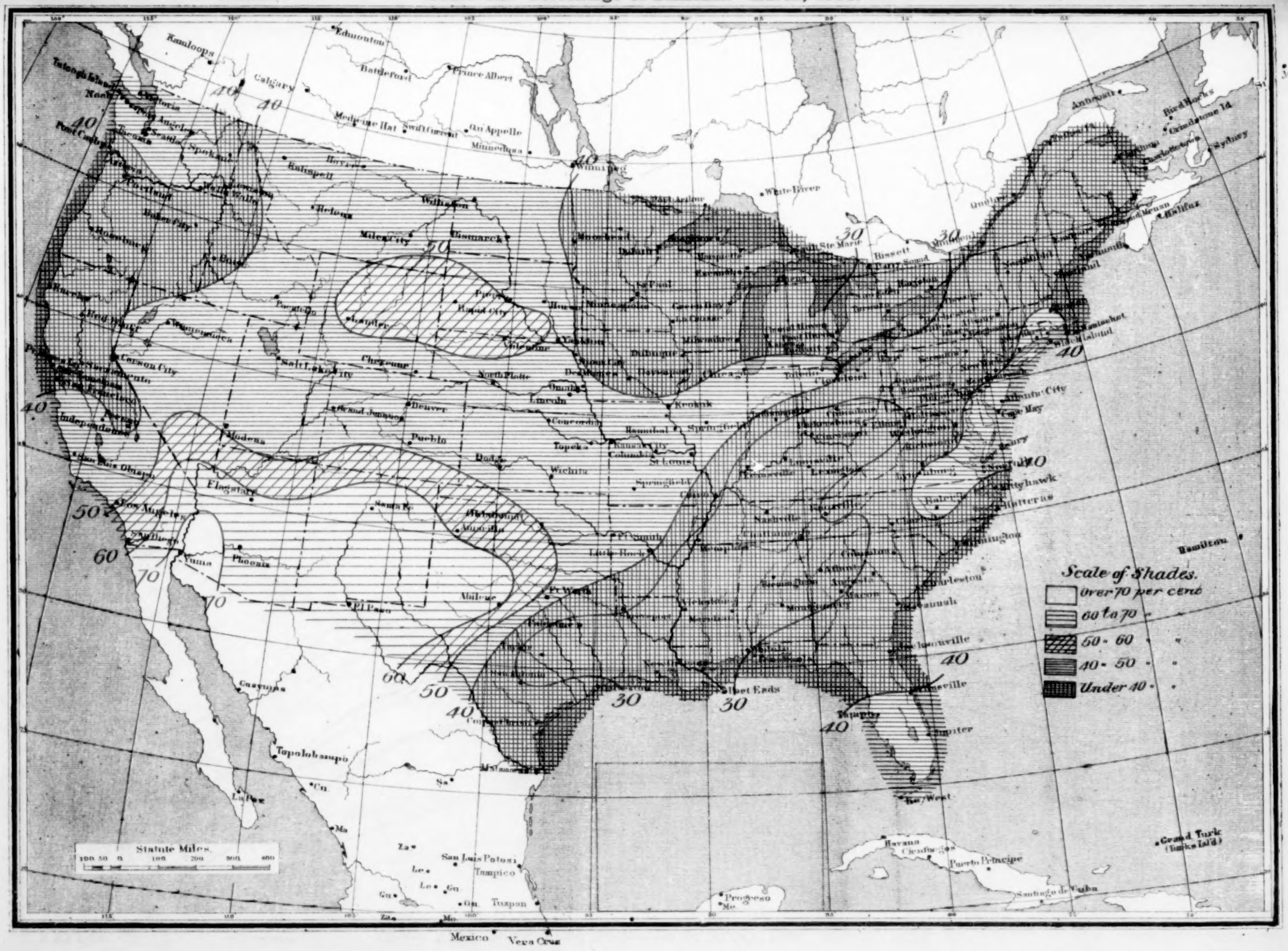


Chart VII. Percentage of Sunshine. March, 1903.

Chart VII. Percentage of Sunshine. March, 1903.



• Barkerville

Chart VIII. Isobars and Isotherms at 10,000 feet. March, 1903,

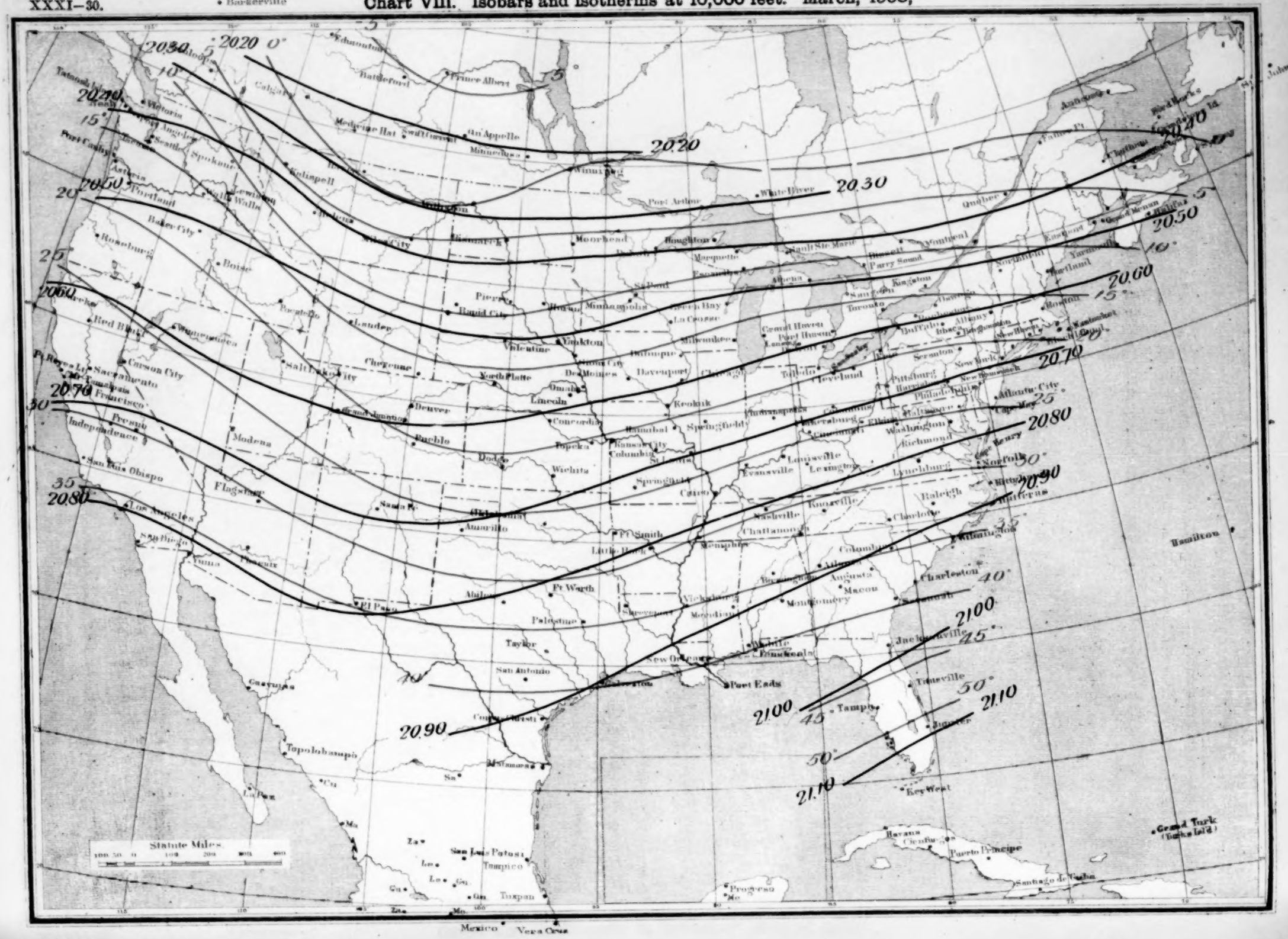


Chart IX. Isobars and Isotherms at 3,500 feet. March, 1903.

Chart IX. Isobars and Isotherms at 3,500 feet. March, 1903.

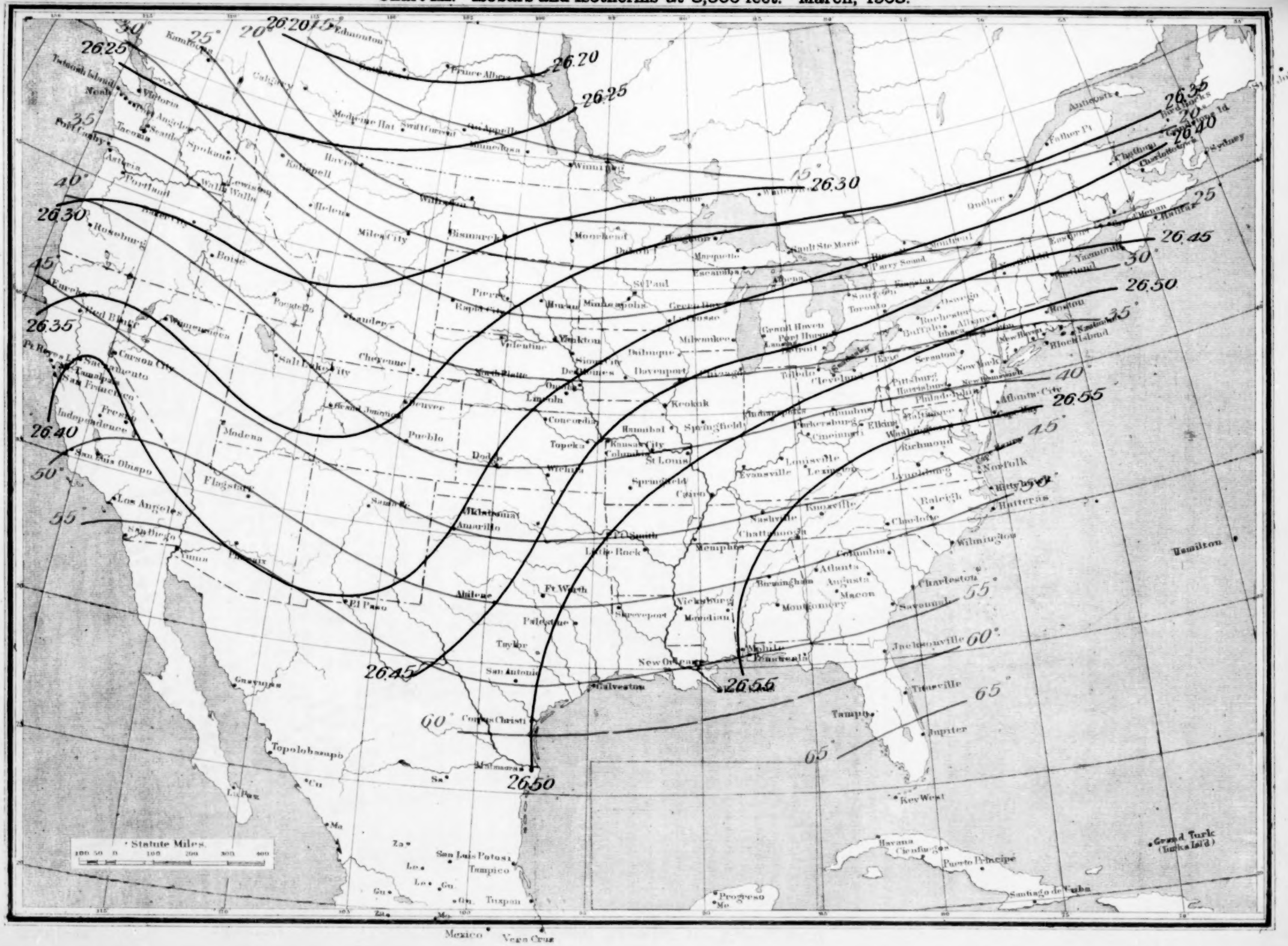
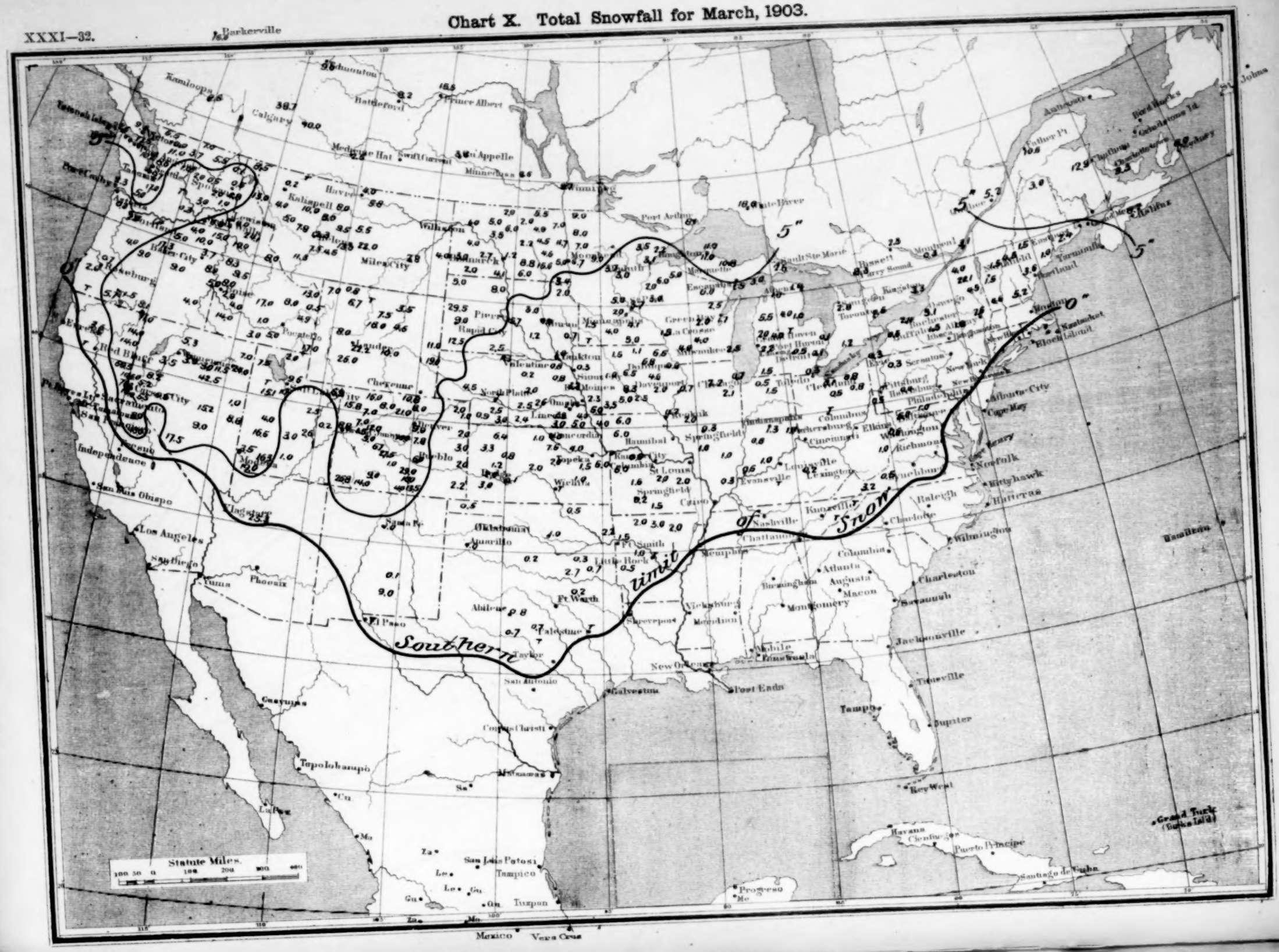



Chart X. Total Snowfall for March, 1903.